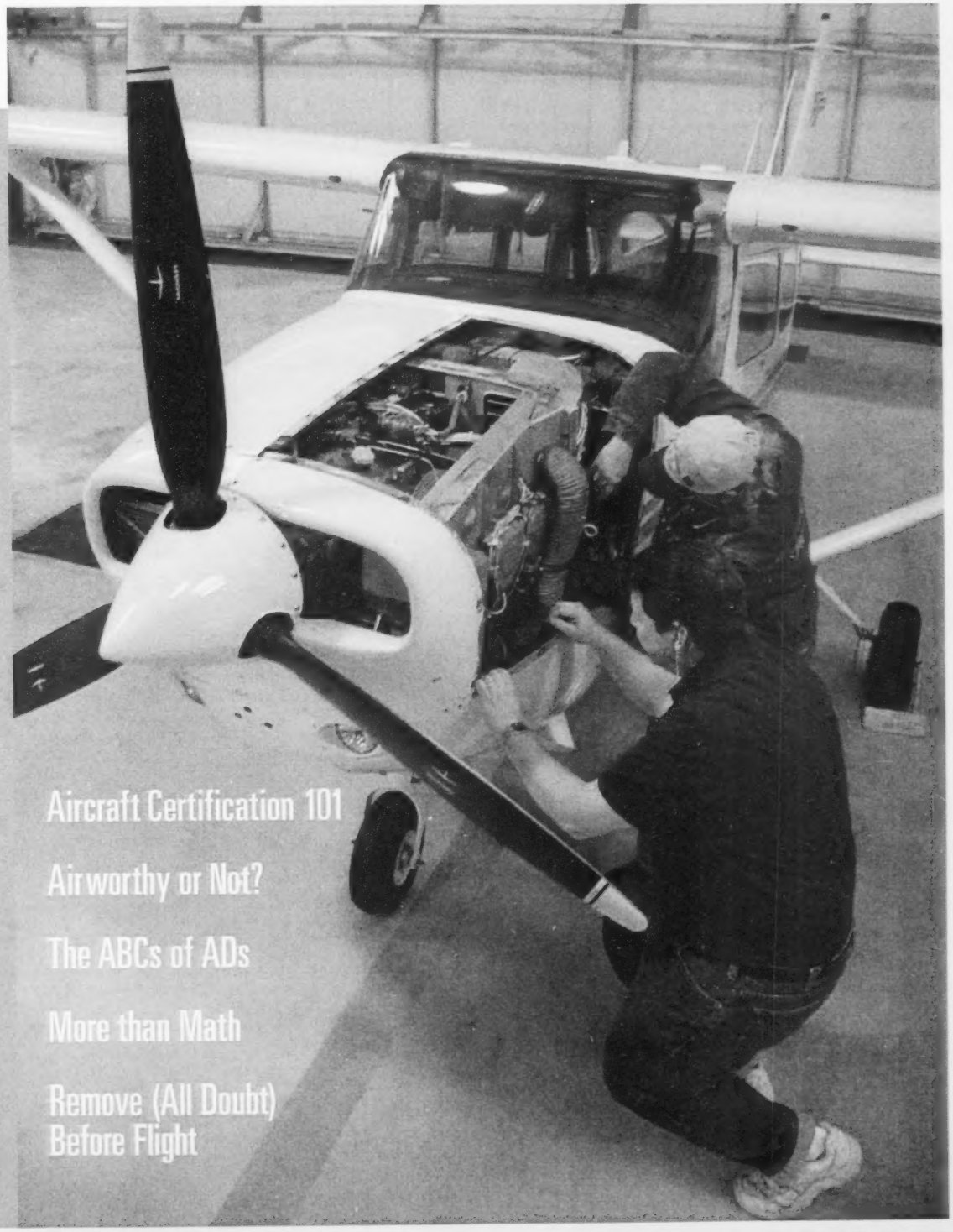
FAA Aviation News

SAFETY FIRST FOR GENERAL AVIATION

May/June 2009



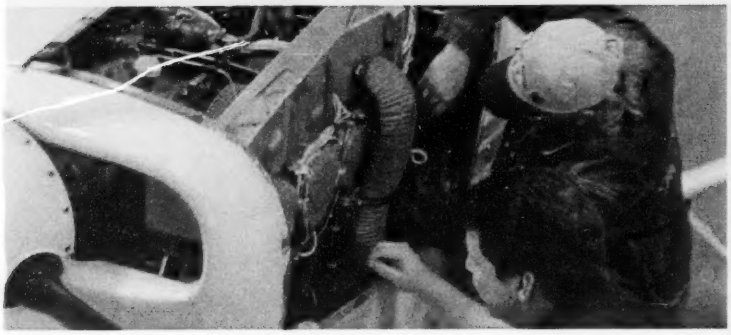
Aircraft Certification 101

Airworthy or Not?

The ABCs of ADs

More than Math

Remove (All Doubt) Before Flight



In this issue, we focus on FAA's responsibility to set standards for aircraft certification and airworthiness, as well as the important role that pilots and mechanics play in ensuring safety.
Cover: Photo by Tom Hoffmann

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Jumpseat

JOHN M. ALLEN
DIRECTOR, FLIGHT STANDARDS SERVICE

Take Me Out to the Air Show

I love air shows. I wish I could head out this spring to Marysville (CA), Manitowoc (WI), Millville (NJ), and more, to watch military jets, see aerobatic acts, and explore static aircraft displays. Even more, I would go to enjoy the company of aviators and aviation supporters. We are a fun bunch. We love to share the wonder of aviation. In the United States one big way we share the wonder each year is at some 400 air shows at airfields and military bases across the country.

FAA's role is to assure the safety of the tens of millions of people who attend air shows each year. At the same time, our regulatory role involves enabling eye-popping performances, such as the great ones I saw last September at the Reno National Championship Air Races and Air Show.

FAA supports air show safety by following the guidance in Volume 3, Chapter 6 of FAA Order 8900.1. We need to be particularly careful because much of the flying at air shows, e.g., aerobatics, high airspeeds, and low-altitude flying, does not comply with federal aviation regulations and can require rules to be waived. This is why we carefully develop special provisions to allow air show flying that still meets safety standards. These provisions prescribe such things as the distance that certain types of flying must be from spectators, practice and experience requirements for formation aerobatic teams, and certification requirements for aerobatic pilots, to name just a few.

For each air show, a nearby Flight Standards District Office (FSDO) works with the air show operator to issue waivers from the regulations. Air shows require months of lead time and coordination. The FAA designates an inspector-in-charge (IIC), who is responsible for issuing the waiver(s) and conducting surveillance of the air show. The IIC's top priority is to protect non-participating persons and property on the ground as well as other users of the National Airspace System.

Assuring spectator safety basically depends on aircraft speed. For example, the U.S. Air Force Thunderbirds, like all jets, are kept 1,500 feet away from the crowd line. At the Vertical Challenge, an all-helicopter air show held in San Carlos, California, the crowd line is at 500 feet. IIC Matt Hill of the San Jose FSDO tells me that this show only requires a waiver for an aerobatic helicopter that does loops and rolls 1,000 feet from the spectators.

The Reno National Championship Air Races and Air Show presents a number of challenges to spectator safety. Because of the event's size and complexity, IIC Reid Walburg solicits a number of volunteers from the Reno FSDO to provide assistance.

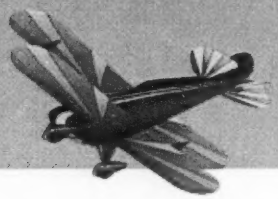
I hope everyone who promotes and participates in air shows and air races keeps safety foremost. Since the current rules were implemented nearly 50 years ago, there has not been a single U.S. air show spectator fatality. This is an outstanding record. Air show operators and FAA's National Air Show Coordinator, regional coordinators, and inspectors from our FSDOs deserve a lot of credit.

While air shows and races are lots of fun, they also promote aviation by helping bring people, especially young people, into aviation. This is so important. The excitement of air shows is about kids getting their first, or second, or even third exposure to aviation and getting the aviation "bug." Or, it could be the combination of flying and excitement that strikes a young person's imagination and leads him or her to follow a dream.

Air shows and air races contribute to aviation's future. Tomorrow's aeronautical engineers, pilots, mechanics, controllers, and yes, even regulators, frequently get their first aviation thrill from these events. It was at an air show, sitting on my dad's shoulders, oh so many years ago, where I first got bitten by the aviation bug.

This year, I'm pleased I have attending air shows on my schedule. I look forward to seeing you there. I'll be the one looking up with the big grin on my sunburned face.

JAMES WILLIAMS



AV News

FAA Tech Center Evaluates Future Fuels

"Initial FAA testing of a future bio-derived fuel shows promise as a possible replacement for 100LL," reports David Atwood, an engineer working at FAA's Alternative Aviation Fuel and Engine Test Facility at the William J. Hughes Technical Center in New Jersey. Initial full-scale engine tests have been completed and revealed the fuel displays an excellent resistance to detonation and produces 98 percent of the power produced when operating on 100LL, both critical factors in developing a sustainable environmentally friendly fuel.

The fuel technology has been patented by Swift Enterprises. The new fuel is to be made from cellulosic biomass, which uses landfill waste and switchgrass, among other feedstocks, to ferment acetone from which it then manufactures a 100-plus octane fuel. It should be noted that the fuel the FAA Technical Center tested was made by a refiner in an expensive process and not in Swift's proposed process. Swift is in the process of developing "proof of concept" pilot plants. According to a proposal it presented to an industry research council last year, Swift proposes the price of manufacturing the renewable fuel will be less than $2 a gallon. However, this estimate does not include distribution, marketing, and other substantial costs.

The FAA is planning further engine endurance testing on the Swift fuel in 2009 to investigate the effects of higher engine temperatures and potential engine deposit formation. According to Atwood, further testing will be needed on blends of the Swift fuel and 100LL. Extensive flight testing, as well as testing of the fuel manufactured in the actual bio process, will also be required to ensure it is free of harmful impurities or byproducts. Testing for compliance with FAA certification requirements will be the responsibility of Swift and FAA will require the Swift fuel have an American Society for Testing and Materials (ASTM) standard specification (or equivalent).

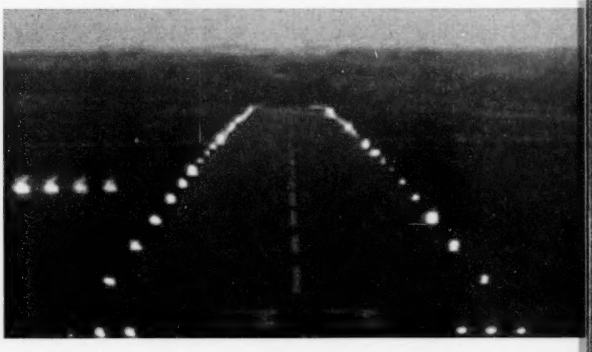
FAA to Install More PAPIs at Airports

The FAA is set this spring to start flight checks of several newly-installed Precision Approach Path Indicator (PAPI) systems at general aviation and major commercial airports across the country. The PAPI system—four simple lights, colored red or white—helps pilots flying under visual flight rules to stay on the proper glidepath while making runway approaches.

"The PAPI gives pilots a visual cue to let them know if they are too high, too low, or just right," said Donald Lampkins, a project manager with FAA's Lighting Systems Group, Navigation Services.

The new PAPI will replace an older version of approach lights, known as Visual Approach Slope Indicators (VASI), which are in the process of being phased out.

The older models used a more complicated system of lights and varied from airport to airport. The PAPI will stay consistent and are constructed using a more reliable solid-state technology. PAPI will be installed at some general aviation airports, which were selected based on studies that showed they were at the highest risk for controlled flight into terrain. The new systems will also be installed at major airports, such as Baltimore-Washington International



Thurgood Marshall Airport and Orlando International Airport to comply with international agreements and improve operations.

The FAA will buy 60 systems this year and pay for the installation and maintenance. In the future, Lampkins said, PAPI systems will be standard at all major commercial airports.

FAA Issues Cessna Seat SAFO

The FAA issued a Safety Alert for Operators (SAFO) to address inflight slippage of pilot and co-pilot seats on Cessna models 310, 336, and 337, as well as all legacy (pre-1986) single-engine models. The alert reminds inspectors, operators, owners, and maintenance technicians of the mandatory requirement to comply with the repair and inspection procedures as outlined in AD 87-20-03 R2. This AD requires periodic inspections of the seat tracks and repair or replacement of the tracks, as necessary.

The increase of seat slippage issues in recent years prompted a renewed focus on this matter. The alert also urges pilots and operators to become familiar with the requirements and intervals of the AD, as well as confirm compliance with regards to your aircraft. To view the AD, go to www.faa.gov,, select ADs and search AD 87-20-03 R2.

Use Caution with ELT Disposal

The Civil Air Patrol (CAP) and the Aircraft Owners and Pilots Association (AOPA) have joined together to remind aircraft owners and maintainers to use caution when disposing 121.5 MHz Emergency Locator Transmitters (ELT). Since the February 2009 phase out of satellite coverage of 121.5 MHz ELT signals there could be a surge in replacing ELTs with the new 406 MHz ELTs. CAP and AOPA are concerned that the improper disposal of these ELTs could lead to many false alarms.

The organizations recommend "...to first remove or disconnect the battery from the device so it cannot be accidentally activated. Then, contact a local electronics waste facility for proper disposal." While FAA supported the phase out of 121.5 MHz satellite coverage, remember there is no regulatory requirement to replace 121.5 MHz ELTs and FAA has no plans to mandate such a change. Yet, some countries may require 406 MHz ELTs and if you plan to fly internationally, FAA advises you to check with the appropriate civil aviation authorities.

FAA's Reinterpretation of "Known Icing"

In January 2009, FAA's Office of General Counsel, in coordination with the Flight Standards Service, issued a reinterpretation of known icing conditions as it pertains to general aviation flight operations. The new letter of interpretation provides operationally practical guidelines for aircraft not certificated for flight into known icing conditions. One of the key points outlined is for pilots to act in a reasonable, safe, and prudent manner when conducting such flights. This means operating outside of icing conditions—ideally clear of clouds or in warmer than freezing temperatures.

Should icing be encountered, the pilot must have an available exit strategy and implement it in a timely manner. If ATC assistance is needed, this too should be requested without delay. Pilots are always encouraged to give icing pilot reports (PIREP), as well as "negative icing" PIREPs. These actions can significantly enhance safety, reduce accidents, and benefit the entire aviation community. The FAA will initiate action to revise the regulations and advice materials based on this latest interpretation.

Aviation Fatigue Symposium Proceedings

The FAA recently made available the proceedings from the 2008 Aviation Fatigue Management Symposium. Participants at this first-of-its-kind event represented a broad spectrum of air carriers, employee groups, government agencies, manufacturers, academics and scientists, The symposium provided current information on fatigue physiology, management, and mitigation alternatives. Participants also shared ideas about fatigue risk management and best practices.

"This event brought useful and interesting science, perspectives, and ideas on fatigue management to the table," stated Aviation Safety Inspector and co-coordinator of the symposium Rick Huss. "The discussions will significantly strengthen the framework for future development of fatigue mitigation strategies."

Go to www.faa.gov/news/conferences_events/2008_aviation_fatigue/ to access a copy of the proceedings.

FAAST

Federal Aviation Administration

SAFETY TEAM

Got Safety?

Are you planning a cross-country flight? Do you want to expand your knowledge on maintenance procedures? Are you looking for local safety/TFR information? At www.FAASafety.gov, the FAA Safety Team has a host of safety resources: online learning center, information about safety events and seminars, and much more. Log on today!

www.FAASafety.gov

FEDERAL AVIATION ADMINISTRATION

Cessna photo

SUSAN PARSON

Checklist

Mapping the Maintenance Paper Chase

In his "Remove (All Doubt) Before Flight" article on page 24, Doug Stewart advocates an informed and methodical approach to preflight inspection. Throughout this issue, articles by FAA's Small Airplane Directorate staff endeavor to help you become better informed about how FAA defines airworthiness, and how to determine and document that your aircraft meets those requirements. Here's a methodical way to gather and check those critical documents.

Step One – Type Certificate Data Sheet

As Steve Thompson writes on page 8, the type certificate (TC) documents FAA approval of the aircraft type design. The Type Certificate Data Sheet (TCDS) for the aircraft provides a formal description of the aircraft, engine, or propeller, along with limitations and information on items such as airspeed, weight, and thrust limits. The Regulatory and Guidance Library on FAA's Web site includes a database of TCDS documents. There are various ways to search, but I used make/model to find the TCDS for my flying club's Cessna *Skylane*. You need the model year letter to get the right TCDS; for instance, I needed the C182 K TCDS.

Step Two – Repairs and Modifications

All airplanes need repairs, and all repairs must be correctly documented. Your aircraft needs an FAA Form 337 any time it has undergone a major repair or major alteration, as defined in Appendix A to Title 14 Code of Federal Regulations (14 CFR) part 43 and 14 CFR part 1 (definitions). The exception is 14 CFR part 43 Appendix B paragraph (b), which provides an exclusion for repair stations to perform major repairs and not execute FAA Form 377. It is important to understand that Form 337 falls into the "necessary-but-not-sufficient" category. An aviation maintenance technician (AMT) must also document the work in the aircraft's maintenance logs. Maintenance records for my club's C182 K include not only logbook entries for the major repair from deer-strike damage, but also the associated Form 337s.

Remember that complex work performed on the airplane may include major changes to type design, which require approval through a supplemental type certificate (STC). The STC documents FAA's approval of a product (aircraft, engine, or propeller) modification. It defines the product design change, states how the modification

affects the existing type design, and lists affected serial numbers. Examples of alterations that require an STC include changes to primary structure that could adversely affect strength or flutter/vibration characteristics.

To find out whether FAA has approved any STCs for your aircraft make and model, you can search FAA's STC database. For example, one of the many STCs issued for the C182 K provides for installation of the J.P. Instruments Primary Engine Data Management System.

To find out whether FAA has approved any STCs for your aircraft make and model, you can search FAA's STC database.

Your aircraft records should include all the necessary paperwork, but if you need a copy of the records FAA holds for a specific N-number, or if you simply want a copy for comparison and verification purposes, the box below includes a Web site address you can use to request it.

Step Three – Inspections

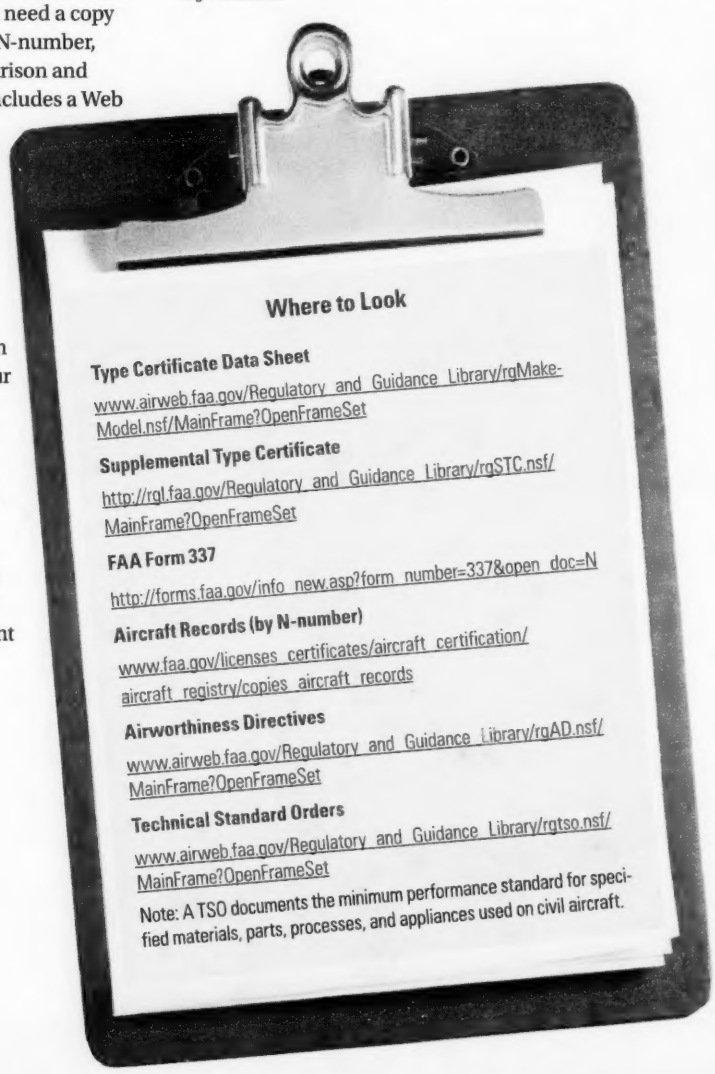
Barry Ballenger's article on page 15 lists key inspection and maintenance items needed to ensure that your aircraft is indeed airworthy. You should be able to find aircraft maintenance log entries for completion of the annual or (if applicable) 100-hour inspection, which includes a check of applicable airworthiness directives and checks for certain operations, e.g., VOR and altimeter/pitot-static checks, transponder checks, and emergency locator transmitter (ELT) battery.

The FAA-approved airplane flight manual (AFM) describes the aircraft's operating limitations (including current aircraft weight and balance). It will also list required placards and markings. The AFM limitations section for many newer aircraft includes a "Kinds of Operations Equipment List" to supplement the basic day and night VFR/IFR equipment requirements in 14 CFR part 91.

Though you aren't likely to review the TCDS before every flight, you'll learn a lot from locating and reviewing the documents described here. A good pilot can never learn too much about the aircraft.

Safe flights and happy landings!

Susan Parson is a special assistant in Flight Standards Service's General Aviation and Commercial Division. She is an active general aviation pilot and flight instructor.



Where to Look

Type Certificate Data Sheet
www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgMake-Model.nsf/MainFrame?OpenFrameSet

Supplemental Type Certificate
http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSTC.nsf/MainFrame?OpenFrameSet

FAA Form 337
http://forms.faa.gov/info_new.asp?form_number=337&open_doc=N

Aircraft Records (by N-number)
www.faa.gov/licenses_certificates/aircraft_certification/aircraft_registry/copies_aircraft_records

Airworthiness Directives
www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAD.nsf/MainFrame?OpenFrameSet

Technical Standard Orders
www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgtso.nsf/MainFrame?OpenFrameSet

Note: A TSO documents the minimum performance standard for specified materials, parts, processes, and appliances used on civil aircraft.

FREDERICK E. TILTON, M.D.
FAA FEDERAL AIR SURGEON

Aeromedical Advisory

Fighting Fatigue

Taking care of your aircraft is a key focus of this issue, but it is also important to take care of the pilot. A vital part of caring for the pilot is dealing with fatigue, which is an inescapable aspect of life. For the average individual, it is a minor inconvenience. For a pilot, though, its consequences can be disastrous.

Fatigue and Aviation

Fatigue is characterized by increased discomfort with lessened capacity for work, reduced efficiency of accomplishment, and loss of capacity to respond to stimulation. It is usually accompanied by a feeling of weariness. The cause of fatigue is not as important as its negative impact on a person's ability to perform tasks. Several studies have demonstrated that fatigue can significantly impair the ability to carry out tasks that require manual dexterity, concentration, and higher-order intellectual processing—all of which are required to safely pilot an airplane.

Although general aviation pilots are not typically exposed to the circadian disruptions common to many airline pilots, fatigue from other causes, in combination with the relatively higher workload of single pilot operation, can create a safety hazard. These dangers can be exacerbated if, as is often the case, the pilot does not recognize the existence or degree of fatigue. Studies show that fatigued individuals consistently underestimate how tired they really are, as measured by physiologic parameters such as sleepiness, difficulty concentrating, apathy, annoyance, increased reaction time, decreased vigilance, memory problems, task fixation, and increased errors while performing tasks. Individuals may also fail to realize that fatigue cannot be overcome by experience, motivation, medication, coffee, or willpower.

Antidotes and Prevention

Adequate sleep is the best way to prevent or resolve fatigue. Sleep gives the body a period of rest and recuperation. On average, a healthy adult does best with eight hours of uninterrupted sleep. Medical conditions (e.g., sleep apnea, insomnia) can influence the quality and duration of sleep. Social and behavioral issues play a role, too. Late-night activities, excessive alcohol or caffeine use, travel, interpersonal strife, uncomfortable surroundings, and shift work can all have an adverse impact on sleep quality and duration.

Lifestyle changes are not easy for individuals; nevertheless, GA pilots should make every effort to modify factors that cause fatigue. Here are a few tips:

Do...

- Be mindful that some medications can cause drowsiness or impaired alertness.
- Consult a physician to diagnose and treat any medical conditions causing sleep problems.
- Create a comfortable sleep environment at home and, when traveling, select hotels that provide a comfortable environment.
- Turn in at the same time each night, and get into the habit of sleeping eight hours per night.
- Limit daytime naps to 30 minutes, since longer naps produce sleep inertia.
- Get plenty of rest and minimize stress before a flight. If problems preclude a good night's sleep, rethink the flight and postpone it accordingly.

Fatigued individuals consistently underestimate how tired they really are.

Don't...

- Consume alcohol or caffeine within three to four hours of going to bed.
- Eat a heavy meal just before bedtime.
- Take work to bed.
- Exercise within two to three hours before bedtime.
- Use sleeping pills (prescription or otherwise).

For more information on this subject and other important topics, take a look at the brochures at http://www.faa.gov/pilots/safety/pilotsafetybrochures/.

Good health and safe flying!

Dr. Tilton received both an M.S. and a M.D. degree from the University of New Mexico and an M.P.H. from the University of Texas. During a 26-year career with the U.S. Air Force, Dr. Tilton logged more than 4,000 hours as a command pilot and senior flight surgeon flying a variety of aircraft. He currently flies the Cessna Citation 560 XL.

Aircraft Certification 101

STEVE THOMPSON

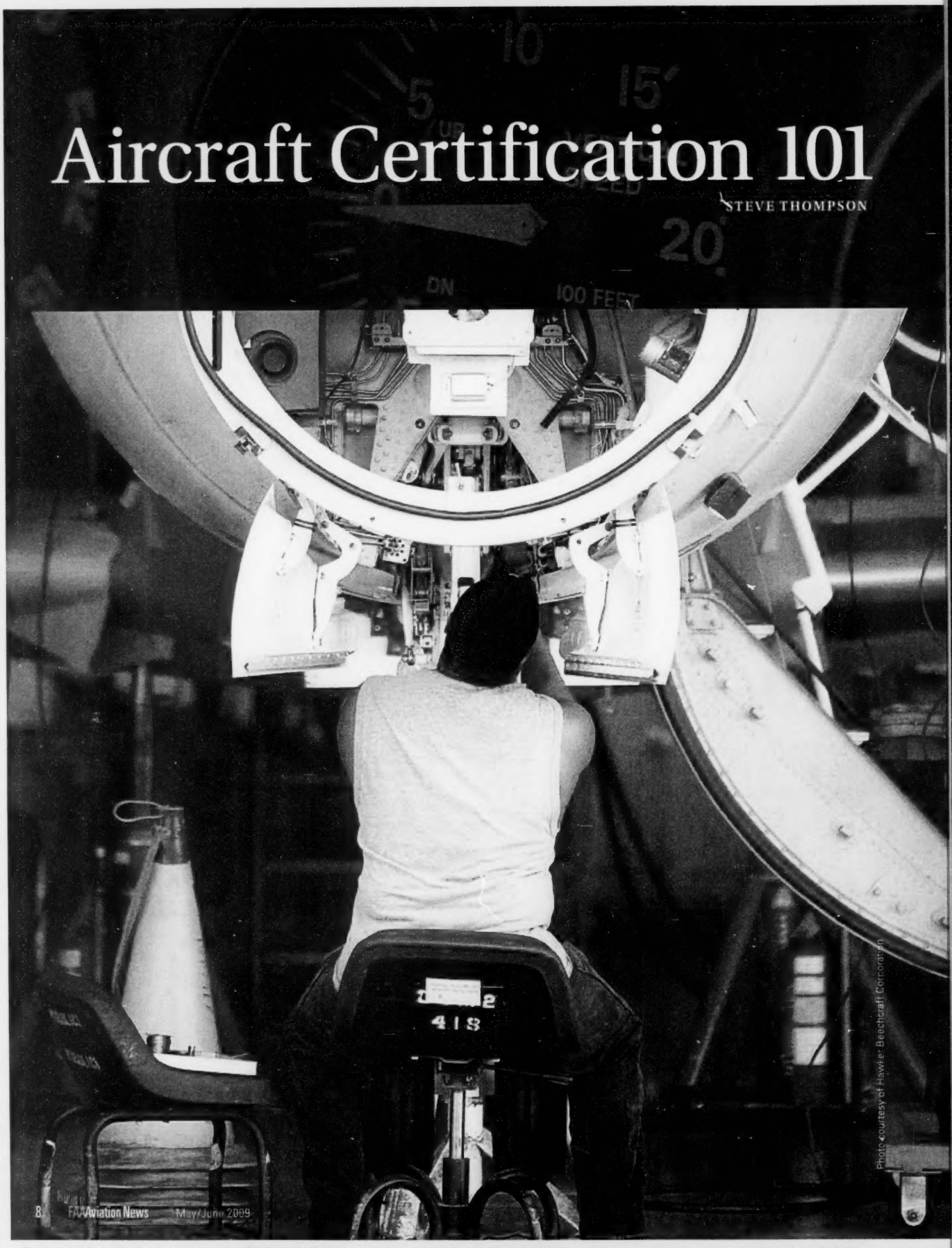


Photo courtesy of Hawker Beechcraft Corporation

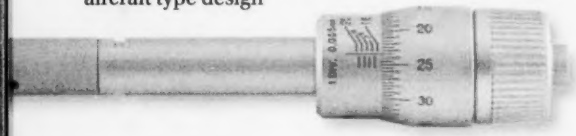
Photo courtesy of General Aviation Manufacturers Association

Chances are you have heard the term "FAA certified" many times. After all, one of FAA's key roles is certifying people, organizations, and equipment to provide a safe National Airspace System. However, the word "certified" can have various meanings, depending on the context. For one, you likely remember some of the checks you went through to get your latest medical certificate. Or, you undoubtedly recall the exhilaration you experienced the day you completed your checkride and earned your pilot certificate. But, you may not be as familiar with FAA's certification of aircraft and how it affects you.

FAA's Aircraft Certification Service is responsible for overseeing the (a) design, (b) production, and (c) original airworthiness certification of civil aircraft and related products. Each of these three kinds of certification has likely played a role in the safety of the aircraft you fly, unless you have an aircraft with a special airworthiness certificate, e.g., an amateur-built aircraft. Understanding the basics of aircraft certification can help you make sound decisions affecting the airworthiness and operation of the aircraft you own or rent.

Design – Type Certificate

Although not sufficient by itself, a type certificate (TC) is a necessary step along the path to producing and selling aircraft to the public. A TC is FAA approval of an aircraft type design. FAA considers an aircraft type design to include items you might expect, such as drawings and specifications. The type certificate also includes the airworthiness and operating limitations.



To obtain a TC, a company must show that the aircraft design complies with FAA standards. These standards lay the groundwork for safe handling qualities, structural integrity, systems reliability, and other characteristics that many of us take for granted in the aircraft we fly. One of the key ways a company shows compliance with the airworthiness standards is through testing, such as on-ground wing structural tests and inflight spin tests. FAA's role is to examine the type design and oversee the tests to verify the product complies with FAA standards.

Understanding the basics of aircraft certification can help you make sound decisions affecting the airworthiness and operation of the aircraft you own or rent.

A supplemental type certificate (STC) is a TC that FAA issues to approve the modification of an aircraft from its original design. The STC consists of both the Administrator's approval of the change in the product's type design and the type certificate previously issued for the product.

As you might expect, a company seeking a design approval today must show compliance with different standards than those used a decade or more ago. Advances in technology, such as development of inflatable restraints as described in Mark James' and my article on page 12 of this issue, often drive regulatory changes. Other changes to airworthiness standards stem from knowledge gained through accident investigations. You can find the certification basis for your aircraft type by reviewing its type certificate data sheet, available

Photo courtesy of Hawker Beechcraft Corporation

on the Internet at www.airweb.faa.gov. You can access the airworthiness standards at www.faa.gov/regulations_policies.

Production – Production Certificate

A type certificate approves the design, but it says nothing about a company's ability to consistently reproduce that design in aircraft it manufactures for sale to the public. Within a short time after type certificate issuance, a manufacturer typically establishes an FAA-approved production inspection system or obtains a production certificate. The intent of production certification is to ensure that each product conforms to its type design, and that it is in a condition for safe operation. FAA conducts ongoing audits and evaluations to make sure the company's production system continues to meet standards.

FAA's aircraft certification processes work together to promote aviation safety throughout the product's life cycle.

Parts manufacturer approval (PMA) is a combined design and production approval for modification and replacement parts. It allows a manufacturer to produce and sell these parts for installation on type-certificated products.

Airworthiness – Airworthiness Certificate

The last of the three major kinds of aircraft certification is the one you are probably most familiar with—airworthiness. As pilots, our preflight responsibilities include making sure that the aircraft has an appropriate and current airworthiness certificate displayed onboard. The aircraft must meet two conditions for issuance of an airworthiness certificate:

- The aircraft must conform to its type certificate. That is, the aircraft configuration and installed components must be consistent with the drawings, specifications, and other data that are part of the type certificate. That includes any supplemental type certificate and field-approved alterations incorporated into the aircraft.
- The aircraft must be in a condition for safe operation.

Many factors can affect these two conditions after issuance of the airworthiness certificate,

and it is our responsibility as pilots to determine that an aircraft is airworthy before flying it. (See Barry Ballenger's article on page 15 of this issue for more information on the effects of repairs, alterations, wear, and deterioration on an aircraft's airworthiness.)

How Aircraft Certification Affects You

FAA's aircraft certification processes work together to promote aviation safety throughout the product's life cycle—design, production, entry into service, and continued operational safety. Of course, safe design and construction are only part of the picture when it comes to safe aircraft. You can help keep your aircraft airworthy—safe and in conformance with its type design—by maintaining and operating it according to its airworthiness and operating limitations.

The top priority for FAA's Aircraft Certification Service is to oversee the continued operational safety of aircraft and other aviation products after they have entered service. FAA monitors the safety of the fleet and approves manufacturers' design changes that contribute to safety, typically in the form of service bulletins. FAA also issues airworthiness directives to correct unsafe conditions, as described in the article by Tausif Butt and David Hirt on page 18 of this issue.

One of the most important tools FAA has for monitoring the continued operational safety of general aviation aircraft is the service difficulty reporting (SDR) system. With this system, mechanics and others can report malfunctions and defects. FAA uses this system to monitor service experience and identify potential safety issues. These reports are a good source of information on where pilots and mechanics have experienced maintenance problems. To submit or review service difficulty reports, go to: www.faa.gov/aircraft/safety/alerts/.

If you would like to learn more about aircraft certification, visit www.faa.gov/aircraft/air_cert/. This part of the FAA Web site offers information about obtaining a field approval or supplemental type certificate. You can also iearn more about PMA parts, technical standard orders (TSO), and a variety of other topics.

Steve Thompson is an aerospace engineer at the FAA's Small Airplane Directorate in Kansas City, Missouri. He holds a commercial pilot certificate with multi-engine and instrument ratings.

FAA Airworthiness Certificates

A Standard Airworthiness Certificate (FAA Form 8100-2) is FAA's official authorization for the operation of type-certificated aircraft in the following categories:

- **Normal**
- **Utility**
- **Acrobatic**
- **Commuter**
- **Transport**
- **Manned free balloons**
- **Special classes**

A standard airworthiness certificate remains valid as long as the aircraft meets its approved type design; is in a condition for safe operation; and maintenance, preventive maintenance, and alterations are performed in accordance with Title 14 Code of Federal Regulations (14 CFR) parts 21, 43, and 91.

A Special Airworthiness Certificate (FAA Form 8130-7) is an FAA authorization to operate an aircraft in the U.S. airspace in one or more specialized categories, which are listed in 14 CFR section 21.175. These include:

- **Restricted** (e.g., agricultural, forest/wildlife conservation, aerial survey or patrol)
- **Experimental** (e.g., research and development; crew training; exhibition; air racing; demonstrating compliance with regulations; operating amateur-built, primary kit-built, or experimental light sport aircraft)
- **Light Sport** (e.g., for special light sport aircraft made in accordance with consensus standards)

How New Technology Takes Flight

MARK JAMES AND STEVE THOMPSON

Have you ever wondered how new technology finds its way into general aviation aircraft? At the heart of innovation are companies and individuals who pour their hearts, minds, and finances into developing new or improved products. From advances in avionics to new ideas for propulsion, and everything in between, these pioneers research and develop innovative technologies that often make flying better, safer, or more affordable for the rest of us. Much of this innovation takes place at the grass-roots level of aviation in the United States—the amateur-built (or "homebuilt") aircraft community. The federal aviation regulations governing this segment of flying create an environment where new ideas can be cultivated, developed, and refined relatively quickly.

What about type-certificated aircraft operating with a standard airworthiness certificate? What does it take to introduce new technology into these aircraft? The most common method is through issuance of a supplemental type certificate (STC). Obtaining an STC typically requires a great deal of work for both the applicant and the FAA, especially for new technology that has never before been approved on type-certificated aircraft. All this work is for a good reason. When you purchase and install an approved modification on your aircraft, you expect it to be safe and compliant with appropriate airworthiness standards.

Story of an STC

For a glimpse into the role FAA plays in facilitating the safe introduction of new technology into certificated aircraft, let's take a look at airbags. A few years ago, a company applied for an STC to install airbags in a general aviation airplane. Although airbags have long been standard equipment in cars, this was the first application of airbags in a general aviation airplane.

Airworthiness Standards

The potential safety benefit of airbags was easy to recognize (see box); the challenge for the FAA was in determining appropriate certification standards. When small airplane airworthiness standards (Title 14 Code of Federal Regulations (14 CFR) part 23 and its predecessor Civil Air Regulations (CAR) 3) were written, the FAA did not envision airbag technology. So, the FAA had some homework to do.

Considering that 14 CFR part 23 doesn't require airbags, you might wonder why the FAA would be concerned with standards for their installa-

How Airbags Work

Similar to the restraint webbing in a shoulder harness, airbags work by absorbing energy through slow deceleration of the forward motion. However, they offer the added benefit of distributing impact forces over a wider area of your body (head and upper torso), thus lowering the force on any one part. An airbag used in conjunction with a shoulder harness can prevent or, at least cushion, the impact of contact with interior components.

tion. After all, having airbags would be better than not having them, right? That was actually one of the questions the FAA needed to have answered. Consider what would happen if an airbag inadvertently deployed during a critical phase of flight. Or, what if the airbag, which is built into the restraint itself, weakened the restraint below certification standards? Or, what if the airbag deployed in such a way that it injured the pilot or passenger? Or, how about this one—what if after an appropriate deployment during an accident, the airbag failed to deflate and impeded the occupants' egress from the airplane? These and other considerations influenced the FAA's determination of additional certification standards for the STC project.

Special Conditions

In an aircraft certification project where new technology warrants the development of specific certification requirements, how does the FAA go about implementing those requirements? Amending the airworthiness standards (14 CFR part 23) is a significant undertaking, can take years to complete, and is only appropriate if the revised standards have wide application. Fortunately, the FAA has the ability to issue special conditions, which are regulations that apply to a particular aircraft design. The FAA issues special conditions when it determines that the airworthiness regulations do not contain adequate or appropriate safety standards because of a novel or unusual design feature.

A special condition is an important tool for the FAA because it provides a timely means for the agency to establish appropriate standards for the introduction of novel, innovative technology into the world of type-certificated aircraft. FAA issued special conditions for the airbag STC to address two primary considerations. One, that the airbags perform properly under foreseeable operating conditions. And, two, that the airbags not perform in a manner or at such times that would impede the pilot's ability to maintain control of the airplane or constitute a hazard to the airplane or occupants.

What Happens in a Crash

One of the hazards in an airplane accident is the potential for head impact with the instrument panel. Videos of sled tests used to simulate and study crashes clearly show that a shoulder harness can stretch significantly under maximum crash loads. This is as it should be since the restraint webbing has to stretch in order to decelerate the body gradually rather than subjecting soft human tissue to the trauma that would result from instantly stopping the forward motion. Unfortunately, that same stretching capability also increases the potential for head trauma.

The STC

Once the FAA determined that the applicant had demonstrated compliance with the airworthiness standards, including the special conditions issued specifically for this project, the FAA issued an STC. This STC, which incorporated by reference the original TC, approved not only the airbag modification, but also how that modification affected the original design. If you would like to learn more about the airbag STC and STCs in general, go to www.faa.gov/aircraft/air_cert/design_approvals/stc/.

Mark James and Steve Thompson are both aerospace engineers at the FAA's Small Airplane Directorate in Kansas City, Missouri.

Susan Parson photo

Airworthy or Not?

BARRY BALLENGER

Aviation lore is replete with tales of foolishly fearless flyers whose idea of determining airworthiness was little more than a cursory kick-the-tires-and-light-the-fires "inspection." Fortunately, few pilots today succumb to the lure of the lore. Such derring-do was the undoing of many early aviators, so preflight protocols and aviators' attitudes have both come a long way. In fact, one of the first things the modern student pilot learns is that the pilot in command (PIC) must conduct a thorough preflight inspection and establish that the aircraft to be flown is "airworthy."

What Is "Airworthy?"

Anyone with a sense of self-preservation and regard for passenger safety can agree that it's a good idea to establish airworthiness, but many pilots falter a bit when it comes to understanding what that really means. Airworthy means the aircraft conforms to its type design and is in a condition for safe operation according to section 3.5 of Title 14 Code of Federal Regulations (14 CFR). There is also a definition on the Standard Airworthiness Certificate (FAA Form 8100-2) displayed in your aircraft. It certifies that: "as of the date of issuance, the aircraft to which issued has been inspected and found to conform to the type certificate therefore, to be in condition for safe operation, and has been shown to meet the requirements of the applicable comprehensive and detailed airworthiness code as provided in Annex 8 to the Convention on International Civil Aviation, except as noted herein."

As you see, the Standard Airworthiness Certificate stipulates that an aircraft can be deemed airworthy when it meets two conditions. First, it must conform to its type certificate and any approved changes to the type design. Second, it must be in a condition for safe operation.

For the most part, the preflight inspection you learned to do on your first flying lesson is the mechanism for meeting the second requirement. The PIC checks for obvious defects, which can include worn tires, damage to structure, improper fluid levels, missing fasteners, and inoperative systems. In this connection, the PIC needs to be familiar with the requirements of 14 CFR section 91.213, which sets out the procedure for handling inoperative equipment. In a nutshell: Any item that the regulations require for the type of operation (e.g., day/night, VFR, or IFR) must be in working order for the aircraft to be deemed airworthy and in a condition for safe operation. If any other item is inoperative, 14 CFR section 91.213(d) states that it must be removed or de-activated, placarded, and recorded.

The PIC is responsible for ensuring repairs have been appropriately documented before attempting to operate the aircraft.

Conforming to Type Certificate

The "Terms and Conditions" section of the Standard Airworthiness Certificate offers important guidance on some of the items you must consider in determining whether an aircraft conforms to its type design. Let's review the wording:

Unless sooner surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator, this airworthiness certificate is effective as long as the maintenance, preventive maintenance, and alterations are performed in accordance with parts 21, 43, and 91 of the federal aviation regulations, as appropriate, and the aircraft is registered in the United States.

From this wording, you can infer that part of ensuring conformance with the aircraft's type design is making sure that required maintenance, preventive maintenance, and repairs are performed, and that these actions are accomplished in accordance with applicable regulations.

Title 14 CFR section 91.7

Civil aircraft airworthiness

(a) No person may operate a civil aircraft unless it is in an airworthy condition.

(b) The pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when unairworthy mechanical, electrical, or structural conditions occur.

Title 14 CFR section 91.403

(a) The owner or operator of an aircraft is primarily responsible for maintaining that aircraft in an airworthy condition, including compliance with part 39 of the chapter.

Maintenance and Preventive Maintenance

Consider the mnemonic "AV1ATE" to remember some of the items you need to check to determine that your aircraft conforms to its type certificate:

	What	How Often	Reference
A	Annual inspection & Airworthiness Directives	Every 12 calendar months (ADs are required)	14 CFR 91.409
V	VOR check (if used for IFR)	Every 30 days	14 CFR 91.171
1	100-hour inspection (required if the aircraft is used for hire or certain flight instruction)	Every 100 hours	14 CFR 91.409
A	Altimeter & Pitot-Static System	Every 24 calendar months	14 CFR 91.411
T	Transponder	Every 24 calendar months	14 CFR 91.413
E	ELT (emergency locator transmitter) operation	Every 12 calendar months and battery condition	14 CFR 91.207

Susan Parson photo

Repairs and Alterations

Two other actions that can affect conformance with the type certificate are repairs and alterations to the aircraft.

Repairs: From FAA's standpoint, a "repair" is an action taken to return an aircraft to its current type design, and therefore to an airworthy status. Typical repairs include replacing defective parts, such as a vacuum pump, or making approved sheet metal repairs, such as repairing damage from a bird or deer strike.

Alterations: In FAA parlance, an "alteration" is any action that changes or modifies the original type design. For example, an alteration might involve installation of an engine or propeller not included in the type design.

When a repair or an alteration affects the aircraft's weight and balance, structural strength, performance, powerplant operation, or flight characteristics or operations, it is deemed to be a "major" repair or alteration.

Now for the Paperwork...

Here is the basic rule: Regulations require anyone who performs required maintenance (including inspections), preventive maintenance, repairs, or alterations to document the work. The PIC is responsible for ensuring repairs have been appropriately documented before attempting to operate the aircraft.

So, what are you looking for? You should be able to locate the entries for required maintenance, inspections, and preventive maintenance in the aircraft's maintenance records. For anything that qualifies as a major repair or major alteration, however, the PIC needs to check the aircraft maintenance records as well as for completion of FAA Form 337 ("Major Repair and Alteration").

Form 337 gives FAA, as well as aircraft owners and operators, a record of major repairs and major alterations to the aircraft, along with details and necessary approvals. FAA does not expect the pilot to perform a technical review of the repair or alteration, but the PIC is responsible for ensuring that the required documentation is complete and that the aircraft has been approved for return to service. (Editor's note: See page 32 in the March/April 2009 issue of *FAA Aviation News* for the Nuts, Bolts, & Electrons article on the new electronic version of Form 337, the "e337.")

Cautionary Notes

As you see from this discussion, a lot goes into the PIC's determination of airworthiness. Here are a few things to keep in mind:

- Just as it states, the Standard Airworthiness Certificate is effective only if the aircraft conforms to its type certificate and is in a condition for safe operation at the time you plan to fly. Even if all required maintenance, inspections, and repairs or alterations have been performed and documented, the aircraft is not airworthy if the PIC finds that an item needed for day VFR flight is inoperative. By the same token, the PIC may find all equipment in working order, but if any of the required maintenance, inspections, repairs, and alterations has not been performed or appropriately documented, the aircraft is not airworthy.
- The PIC must realize that any kind of maintenance signoff is a "snapshot" that reflects a specific time. The person performing the work is not liable for future airworthiness. The signed entry only denotes proper performance of the work performed. It is the responsibility of the PIC to establish that the aircraft is airworthy on any given day.

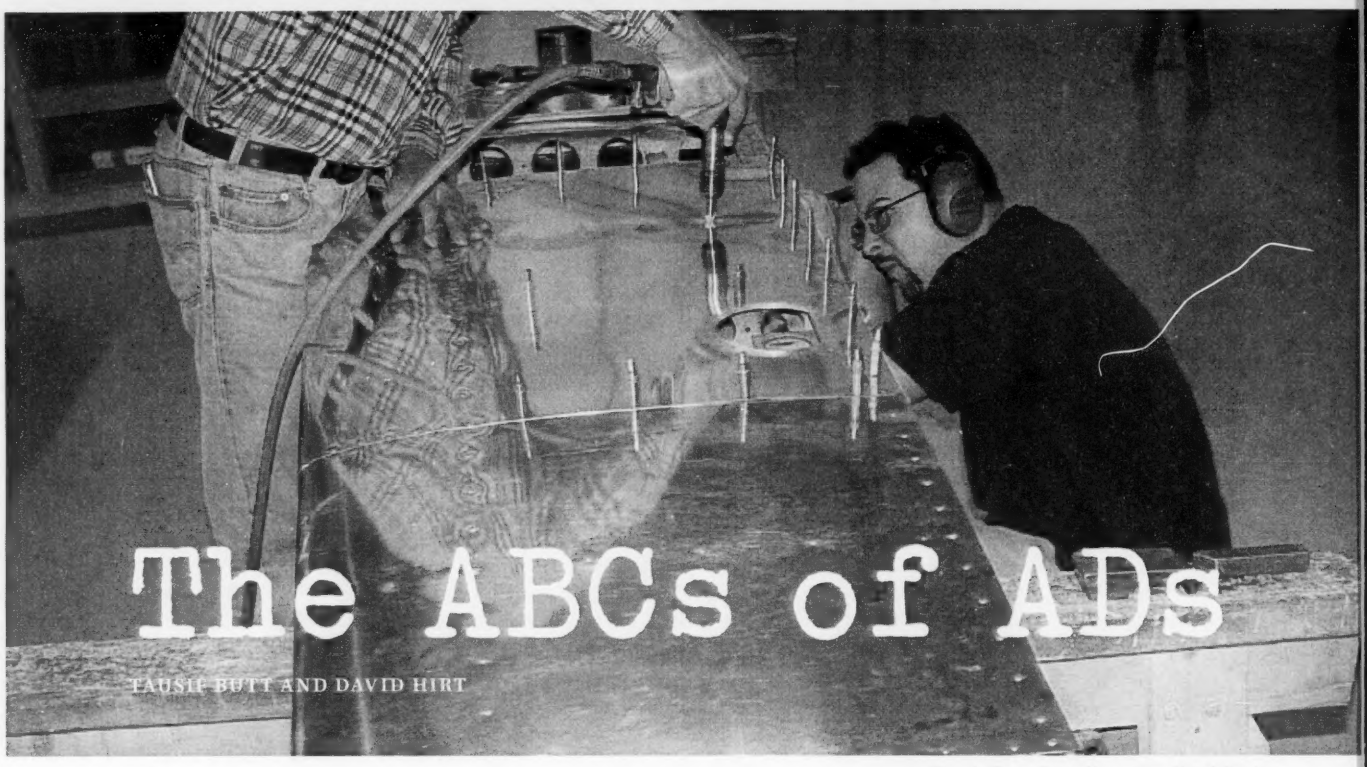
As PIC, you are the final decision maker when it comes to determining if an aircraft is airworthy.

This is very important: If you, as PIC, have any concerns about the condition of an aircraft, don't go flying until you have a properly certificated mechanic or repair facility determine if the aircraft is safe for flight and perform/document any necessary repairs. Finally, although maintenance personnel approve the aircraft for return to service, it is the PIC who actually returns the aircraft to service by flying it. As PIC, you are the final decision maker when it comes to determining if an aircraft is airworthy.

Barry Ballenger is an aerospace engineer at the FAA Small Airplane Directorate in Kansas City, Missouri. He also holds an A&P with Inspection Authorization and is a private pilot.

Need Documents for your Aircraft?

The FAA's Aircraft Registration Branch maintains registration records on individual aircraft and serves as a repository for airworthiness documents received from FAA field offices. To obtain copies of records for a specific aircraft, you can mail or fax the request, or make the request online at: http://www.faa.gov/licenses_certificates/aircraft_certification/aircraft_registry/. For a small fee, the FAA provides either paper copies or electronic copies (on CD-ROM).



The ABCs of ADs

TAUSIF BUTT AND DAVID HIRT

Photo by Tracey Potter, Hagerstown Aircraft Services

Your mechanic calls. He has found a crack in your airplane's wing spar. Your first thought: "What is it going to cost?" His second comment, though, takes your thoughts from money to safety. He tells you that yours is the third aircraft he has found with the same crack in the spar, and one of them was near total failure. Now what?

With this kind of pattern, your mechanic will want to contact an aviation safety inspector (ASI) at the local FAA Flight Standards District Office (FSDO) and report the concern. (Contact information for the appropriate FSDO is available via Internet at www.faa.gov/about/office_org/field_offices/fsdo.) Your mechanic should also submit a malfunction and defect report through FAA. These reports alert other owners and maintenance personnel of the safety issue.

FAA strives to develop ADs that correct the unsafe condition without creating an undue burden for aircraft owners, operators, and pilots.

After your mechanic contacts FAA, the ASI will coordinate with the appropriate FAA engineer to evaluate the safety issue. The engineer will typically analyze the design details and the nature of the reported failure, research related service history, talk with the type certificate holder, and coordinate with other FAA engineers, specialists, and managers. The engineer's evaluation includes conducting a risk assessment, considering items such as the safety impact of the reported condition, the type of aircraft involved, how the majority of those aircraft are used, and how often the condition has occurred in other aircraft of the same or similar type design. Based on this evaluation, the FAA will determine whether there is an unsafe condition that warrants issuing an airworthiness directive (AD).

Once FAA determines that mandatory corrective action is necessary, the agency develops an AD that calls for appropriate actions and sets out timeframes for completing those actions. FAA strives to develop ADs that correct the unsafe condition without creating an undue burden for aircraft owners, operators, and pilots. Some safety issues require immediate correction, that is, repairs must be made before the aircraft flies again. Wherever appropriate, though, FAA develops actions and compliance times that allow for the required work and as little impact to your flying as the situation allows. Yet, there is simply no way to avoid the reality that ADs will affect both your flying schedule and checkbook. FAA works hard to develop corrective actions that address the unsafe condition without requiring more action than necessary.

FAA also tries to write ADs in a way that makes the required action clear and completely understandable to those responsible for the work. This requires consulting pilots, maintenance specialists, technical writers, engineers, legal counsel, and others during development of the AD. FAA also works with the appropriate industry groups to

ensure the availability of any parts, tools, or service instructions necessary to comply with the AD.

Different Types of ADs

The nature of the unsafe condition and the urgency required to correct it determine the type of AD action that FAA takes. Normally, the agency issues a notice of proposed rulemaking (NPRM) followed by a final rule. NPRMs request public comments on the proposed action. After the comment period closes, FAA issues the final rule, taking into account all comments received.

In certain cases, the critical nature of an unsafe condition and the need for timely corrective action may require issuing an AD in final rule form without first issuing an NPRM and allowing time for public comment. In these cases, the agency still provides an opportunity for public comment after AD issuance, and it may change the AD as a result of comments received.

FAA issues an emergency AD when an unsafe condition exists that requires immediate corrective action. The intent of an emergency AD is to rapidly correct an immediate safety of flight situation.

FAA recognizes that you may have information or ideas that had not been considered when developing an NPRM or an AD without a prior NPRM. FAA values the public's input on these proposed or mandated actions and has used input in the past to change compliance times, inspection or maintenance actions, and other items from what was originally proposed or mandated. FAA encourages you to send any ideas or comments you may have about proposed or mandated actions, along with supporting data. Each NPRM or final rule (without prior NPRM) contains details on how to comment.

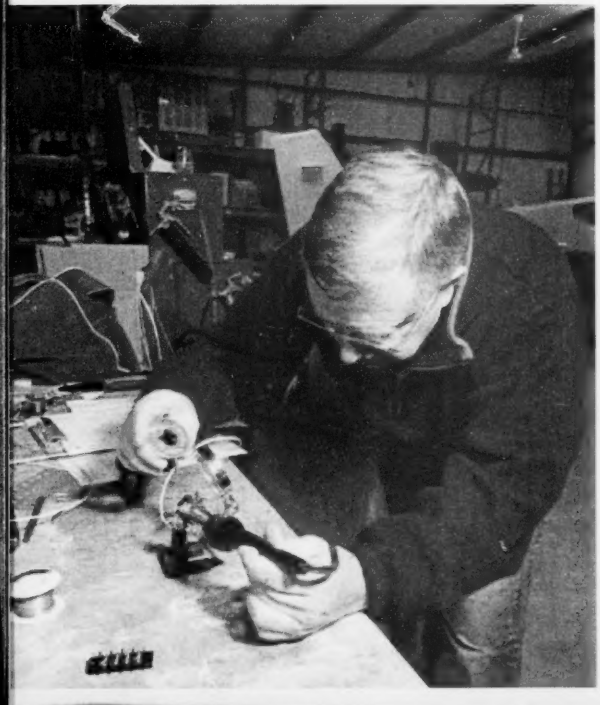
To become aware of when the agency issues NPRMs or final rules that affect your airplane, you can monitor the *Federal Register* on the Internet at www.gpoaccess.gov/fr. Many airplane type clubs monitor the *Federal Register* and inform their members when an NPRM or final rule affecting their aircraft type has been issued.

Once an AD affecting your aircraft takes effect, by regulation you can operate the aircraft only if it meets the requirements of the AD. Unless the condition is an immediate safety of flight concern, the AD will allow you to continue operating the aircraft for a specified amount of time before you must carry out the required actions.

The nature of the unsafe condition and the urgency required to correct it determine the type of AD action.

Alternative Ways to Comply

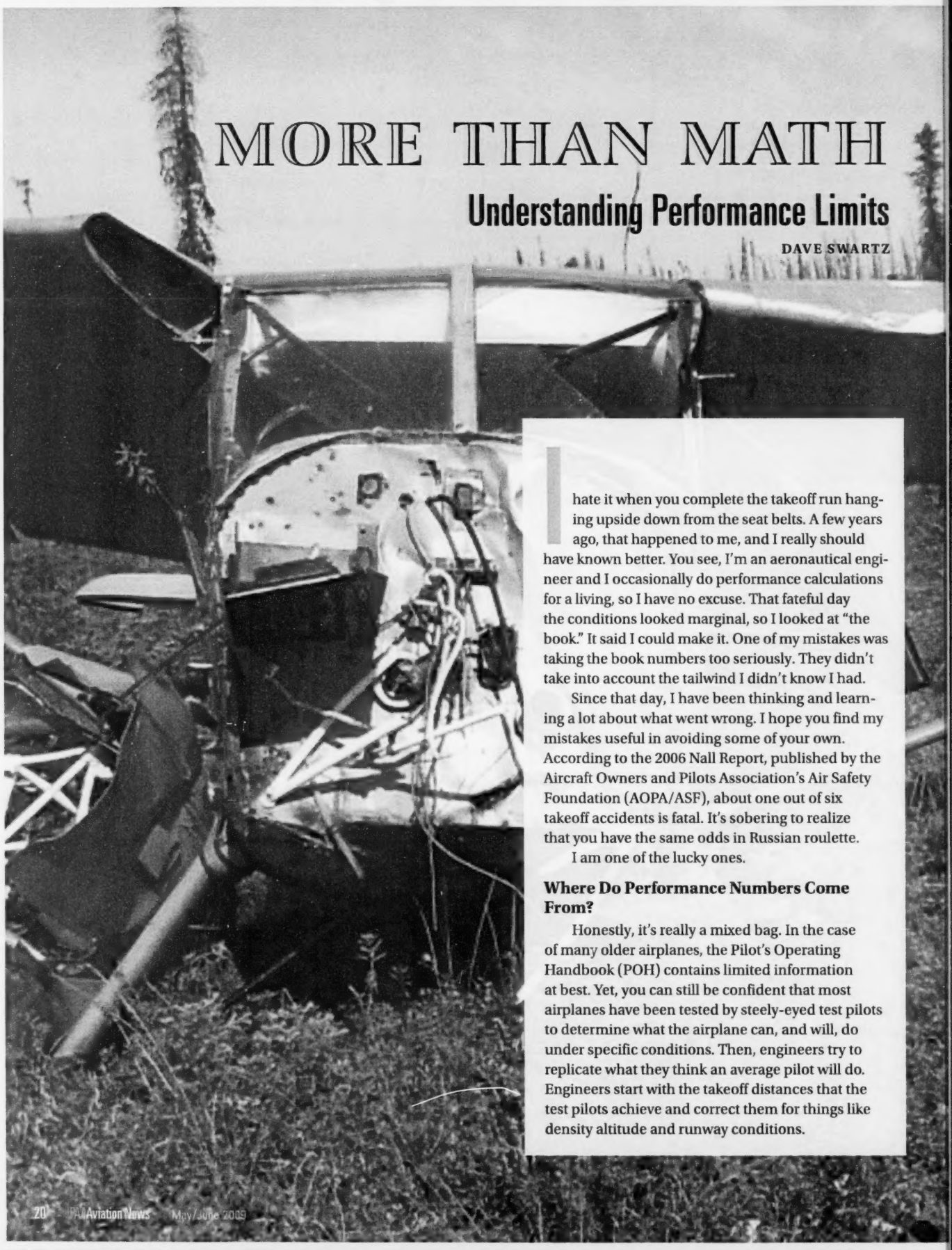
If your mechanic has a better way to address the unsafe condition cited in an AD, FAA does allow alternative methods to comply with an AD's requirements. If you want to propose a different method or compliance time to address the safety issue, you can apply for an alternative method of compliance (AMOC). Submit the proposal through your principal inspector or local FSDO to the Aircraft Certification Office (ACO), which reviews and issues approval or denial. Include the specific actions you are proposing to address the unsafe condition, along with substantiating data. FAA will review your request and determine if the proposal addresses the unsafe condition.



Tausif Butt and David Hirt are aerospace engineers at FAA's Small Airplane Directorate in Kansas City, Missouri.

How Do I Get a Copy of an AD?

The government publishes all NPRMs and ADs in the *Federal Register*. In addition, FAA posts ADs on the Internet at http://rgl.faa.gov, where you can sign up to automatically receive e-mail notification of non-emergency ADs for particular aircraft types. For small airplanes and rotorcraft, FAA distributes emergency ADs by mail to all affected U.S.- registered owners and operators within 24 hours.



MORE THAN MATH

Understanding Performance Limits

DAVE SWARTZ

I hate it when you complete the takeoff run hanging upside down from the seat belts. A few years ago, that happened to me, and I really should have known better. You see, I'm an aeronautical engineer and I occasionally do performance calculations for a living, so I have no excuse. That fateful day the conditions looked marginal, so I looked at "the book." It said I could make it. One of my mistakes was taking the book numbers too seriously. They didn't take into account the tailwind I didn't know I had.

Since that day, I have been thinking and learning a lot about what went wrong. I hope you find my mistakes useful in avoiding some of your own. According to the 2006 Nall Report, published by the Aircraft Owners and Pilots Association's Air Safety Foundation (AOPA/ASF), about one out of six takeoff accidents is fatal. It's sobering to realize that you have the same odds in Russian roulette.

I am one of the lucky ones.

Where Do Performance Numbers Come From?

Honestly, it's really a mixed bag. In the case of many older airplanes, the Pilot's Operating Handbook (POH) contains limited information at best. Yet, you can still be confident that most airplanes have been tested by steely-eyed test pilots to determine what the airplane can, and will, do under specific conditions. Then, engineers try to replicate what they think an average pilot will do. Engineers start with the takeoff distances that the test pilots achieve and correct them for things like density altitude and runway conditions.

Next, they fill out the tables that eventually get published in the POH. These tables give you numbers like 2,479 feet over a 50-foot obstacle at 32°F with a nine-knot headwind at 6,000 feet on the first Monday after a full moon. Okay, the last part is a stretch, but the point is that this level of precision is pretty silly in view of the assumptions involved. I am quite confident that a test pilot can replicate those numbers in the factory airplane 50 percent of the time. I can also tell you that with my level of experience, in a 60-year-old airplane, there was a day I couldn't do it. That day, I learned that the engineers didn't put a safety factor into their takeoff performance numbers. AOPA/ASF recommends adding 50 percent to published takeoff and landing distances. If I had paid attention, my insurance company would be a lot happier today.

The next time you are out practicing on a nice VFR day, consider seeing if you can get the "book numbers." Here's a simple way to test your skills and aircraft performance for takeoff and landing distances. Typically, runway lights are spaced 200 feet apart, so you can count them as they go by. Have a friend or fellow pilot ride along with you and count the lights as you roll by. You, of course, should be focused completely on the business of flying the airplane! Have your helper write the numbers down, and later you can compare them with the POH. You can also use these numbers to start making your own, more realistic, takeoff and landing performance tables.

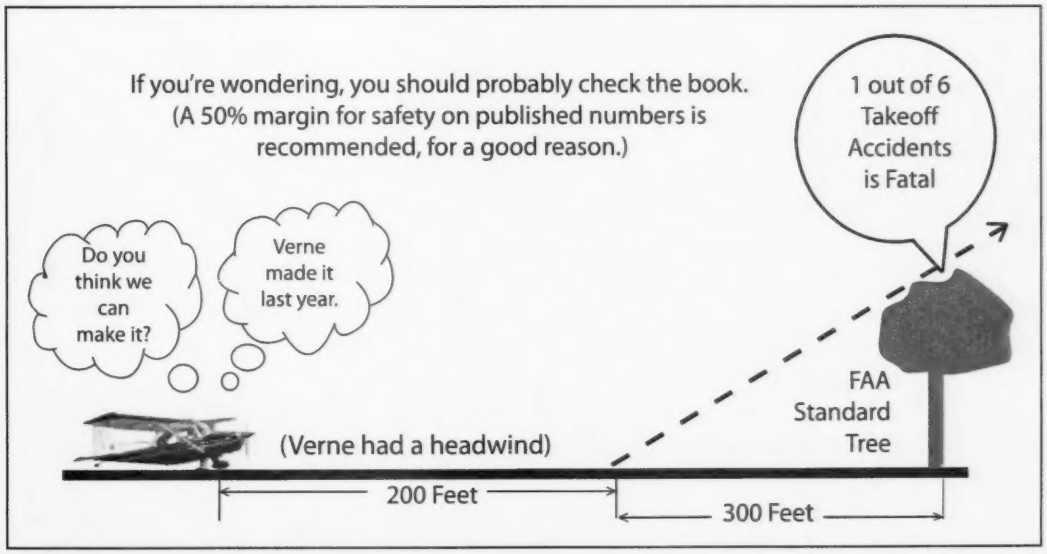
As you work on this project, keep in mind some of the conditions that will affect your takeoff distance. Before I list them, though, please bear this caution in mind: I use some rules of thumb from *The Axioms of Flight* by James Embree, as well as other sources. All rules of thumb are necessarily based on assumptions whose accuracy may be suspect in certain circumstances. These particular rules of thumb are intended for typical light, normally-aspirated, reciprocating single-engine airplanes. When you have good data for your specific airplane, it's usually more accurate.

"Experience is the best teacher; unfortunately, she has been known to kill her students."

For several reasons, higher-density altitude increases your takeoff distances.

1. Normally-aspirated engines make less power. At some point, you may need to lean even for takeoff to get all the power that is available.
2. The propeller is less efficient (not as much thrust for the same power).
3. Your liftoff airspeed is in indicated airspeed, but tire friction depends on ground speed, which will be greater at higher-density altitudes.

Several publications on mountain flying estimate that your takeoff distance will increase by 10 percent for each 1,000 feet in density altitude. While this rule of thumb works for limited differences in density altitude (about 4,000 feet), extrapolations


If you're wondering, you should probably check the book.
(A 50% margin for safety on published numbers is recommended, for a good reason.)
1 out of 6 Takeoff Accidents is Fatal
Do you think we can make it?
Verne made it last year.
(Verne had a headwind)
FAA Standard Tree
200 Feet
300 Feet

Just because someone else made it over an obstacle doesn't mean you will. Check your performance numbers and remember to add a proper safety margin. Illustration courtesy of Dave Swartz.

beyond that can become dangerous because power then starts to fall off more quickly than 10 percent per thousand feet.

Is That Really a 50-Foot Tree?

We generally focus on required takeoff distance. But, given that small airplane climb angles are typically pretty flat, it's much more important to be aware of what obstacles exist beyond the runway and to have a good idea of their height. In the event described at the beginning of this article, I hit a tree that was only about 10 feet tall. Ironically, I then hit the wind sock that was lying in the weeds. The height of the obstacle was undeniably a factor in my rationalization. Even though "the book" said it would be tight, I thought that I could make it because the trees weren't that tall.

The number is not really the most important element: The key is your individual training, proficiency, and comfort level.

Do you know how to estimate obstacle heights? Here's an easy method for getting a ballpark idea on the height of a tree.

- Fold a piece of paper into a 45-degree triangle.
- Sight along the diagonal edge as you walk toward the tree.
- When you see the tree top along the diagonal edge of the paper, the tree height is equal to your distance from it, plus your height.

After you practice this technique a few times, you will have honed your ability to judge how high obstacles are. You may be surprised by what you learn.

Once you know how high the tree is, the next step is to determine whether you can clear it. For this purpose, look at the POH numbers and get the difference between the ground-run distance and the takeoff over a 50-foot obstacle distance. Here's an example: A Piper *Super Cub* POH has a published 200-foot ground roll, with a total takeoff distance of 500 feet to get over a 50-foot obstacle. So, it takes 300 feet from liftoff to clear the obstacle. This means that over a 100-foot obstacle, you would need about 800 feet (500 feet for the first 50 feet, plus an additional 300 for the next 50).

If you are using an "unimproved surface," most POHs have a correction factor. That number usually adds about 15 percent to the ground run. What the correction factor does not necessarily cover is the fact that mud, snow, or tall wet grass can make the ground run much longer. In the case of a ski plane, taking off on clear ice can be very short, but takeoff

The photos in this article are of Dave Swartz's own aircraft after the accident that inspired this article.

distances in deep snow can seem infinite. Landing in deep snow is very short, but landing on ice can also seem infinite unless you shut the engine off completely and throw out an anchor. Seaplane pilots have similarly variable conditions and are especially sensitive to weight.

What about Wind?

We all know that a tailwind hurts you on takeoff, but it is also important to know how much. If your airplane's POH contains correction factors, use them. If not, a good rule of thumb is that for every 10 percent of the takeoff speed, a tailwind will increase the ground run by about 21 percent. For example, with a liftoff speed of 51 knots and a zero-wind takeoff ground roll of 980 feet, the rule of thumb would tell you that a five-knot tailwind will increase your ground roll by about 210 feet. The book for a Cessna 172 shows these same conditions resulting in a published increase of 245 feet (25 percent). The Cessna manual is based on actual flight test information instead of a rule of thumb. (Remember, there is still no margin of safety in these numbers!)

Although headwinds will reduce your takeoff distance by a similar factor, it's important to remember that a headwind can change quickly with altitude, and it can disappear altogether with a gust. If your life depends on the extra performance expected from a headwind, reconsider the takeoff.

Crosswinds negatively affect takeoff performance. That's because they require you to introduce aerodynamic drag with the control surface deflections that keep the airplane on the runway. In addition, performance is affected by drag from the tires scrubbing on the runway.

The Medallion Foundation, an organization committed to reducing aviation accidents in Alaska, has effectively incorporated the concept of personal minimums into its safety seminars. My own personal limit is a five-knot crosswind component. That's because I fly a tail dragger with a fairly strong tendency to weather vane on landing, and that works for me. The number is not really the most important element here: The key is your individual training, proficiency, and comfort level. Think about that before committing to the landing, and take action if it looks like you are over your limit. (Editor's note: Please see the May/June 2006 issue of *FAA Aviation News* for an article on developing your individual personal minimums.)

Propellers

When reviewing takeoff performance numbers, make sure you have the same prop that the chart assumes you have. If your POH numbers are based on a climb prop when your airplane actually has a cruise prop installed, you won't make the book numbers. As an aside, please remember that you can also run out of fuel if you have a climb prop when POH numbers for cruise speed are based on having a cruise prop.

Propellers are routinely filed to remove rock dings. Though necessary, this process compromises the airfoil to some extent. POH numbers are established in an airplane with a new prop. They do not include adjustments for a prop that has been filed down to limits.

Pay Attention!

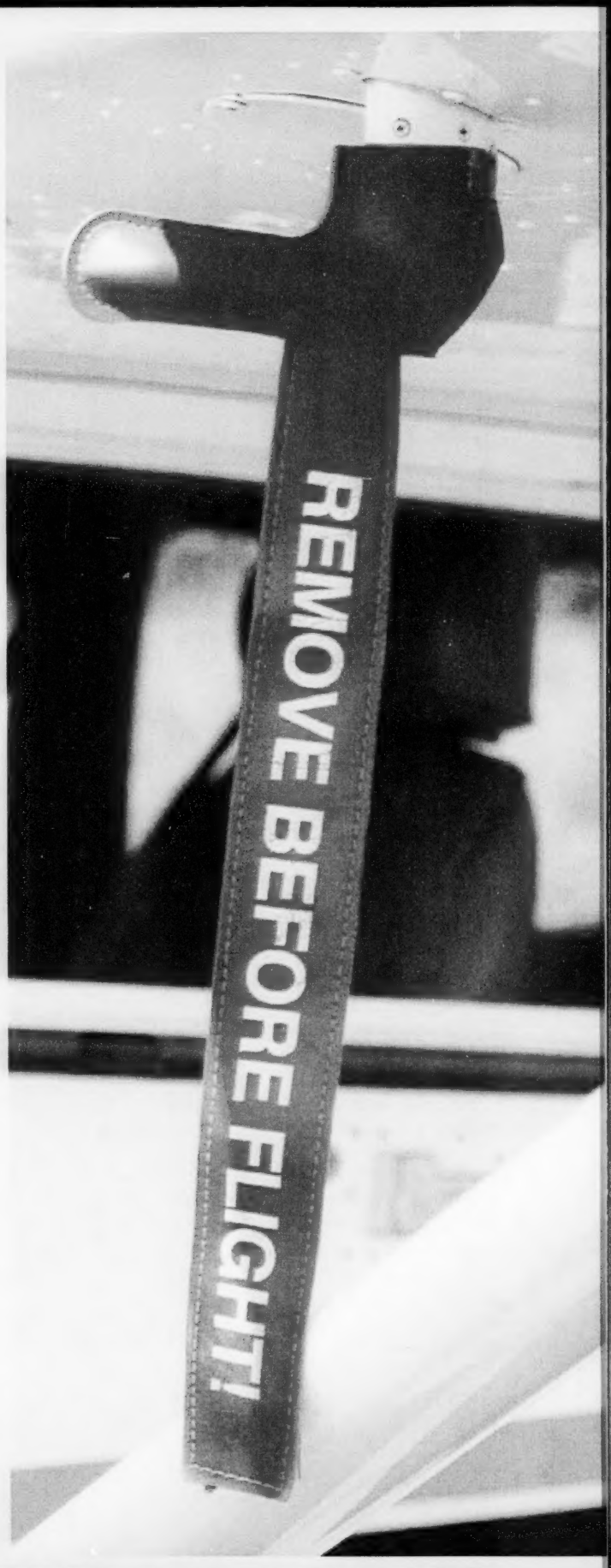
If you don't remember anything else from this article, please note these four short points:

1. Take it from me: It's better to figure out if you are going to make it before you are airborne. When in doubt, do the math.
2. Establish your own personal limits and stick to them.
3. Incorporate a safety factor into the numbers; AOPA/ASF's 50 percent is a good one.
4. Keep learning, and incorporate what you learn into how you fly.

Dave Swartz, PhD, is an aerospace engineer at FAA's Anchorage Aircraft Certification Office. He holds private pilot land and sea ratings and likes to fly on skis. He is the proud owner of a 1949 Aeronca Sedan.

ALL DOUBT REMOVE BEFORE FLIGHT!

DOUG STEWART



"My airspeed indicator isn't working."

The voice on the radio belonged to a client, but since we had previously practiced landings with the airspeed indicator covered up, I had no qualms about his ability to get down safely. My thoughts turned instead to wondering why it wasn't working. I also wondered why the pilot hadn't discovered the problem in his preflight inspection or at the "airspeed's alive" check during the takeoff roll.

The answer to the first question became obvious as the airplane taxied past my window: A bright red streamer with the words "Remove Before Flight" dangled from the pitot mast. Oops.

The answer to the second question seemed obvious as well, since the preflight checklist clearly includes removing the pitot cover. But, people who live in grass houses shouldn't play with matches, so I wasn't about to set a fire under that pilot's ego. The truth is that I once made a similar mistake. Also, I decided that using it as a learning opportunity would be better for all concerned. We could repurpose that embarrassing "Remove Before Flight" streamer as a reminder to preflight in a way that removes all doubt about whether the aircraft is airworthy and safe to fly.

Remove Ignorance

An important thing for every pilot to remove before flight is ignorance. Do you know what constitutes a

proper and thorough preflight inspection? What types of conditions should ground the airplane, even if it were in a flyable condition? What happens if there is a squawk?

Barry Ballenger's article on page 15 provides detailed answers to these questions. His key points bear repeating. To be airworthy, the aircraft must meet two conditions. First, it must conform to a type design. Second, it must be in condition for safe operation, which means ensuring that all required equipment works properly and knowing what the rules, e.g., Title 14 Code of Federal Regulations section 91.213, require if a given item is inoperative.

A responsible pilot must also remove any ignorance about the aircraft's operating limitations, as specified in the FAA-approved Airplane Flight Manual (AFM). As you may know, an AFM is not required if your aircraft was manufactured before March 1, 1979. For these aircraft, the operating limitations and information now required to be furnished in an AFM might exist in a combination of written material, markings, and placards created in accordance with the regulations under which the airplane was originally certificated.

Remove Distractions

A second item to remove before flight is any distraction from the business at hand. It's no exaggeration to say that missing something on the preflight inspection can have life-or-death consequences for humans and "life-or-loss" implications for the aircraft. Consider what happened to a friend of mine who once failed to fully secure one of the fuel caps on his beautiful Cessna 195. His engine spluttered into silence just five miles short of his destination. There were only minor injuries, but the maneuvers required to avoid obstacles resulted in total loss of the airplane. It seems he was distracted during the preflight inspection process, and he missed the chance to find the problem on the ground.

Most of us have heard how important it is to maintain a "sterile cockpit" whenever we are operating on or in the vicinity of an airport. I would argue that it is equally important to consider "sterile preflight" procedures. All it takes is one moment of inattention occasioned by a bystander's unwitting "interference" to miss an important item (like a loose fuel cap). I recommend that my clients tell passengers that they need to focus exclusively on the inspection process and stress that it is for everyone's safety and well-being.

Be mindful as well of distractions that arise from the environment, which can include both weather and other operations being conducted on the airport. Preflight is no fun with gusty winds and sub-freezing temperatures in winter, and it's equally uncomfortable on those summer days when the pavement is hot enough to fry an egg. It takes discipline to avoid the distraction of physical discomfort, but your safety depends on doing the job right. You must also exercise the discipline needed to stay focused even when you'd love to stop and watch some other aircraft, like that beautiful *Staggerwing* that just distracted me from writing this article.

A responsible pilot must remove any ignorance about the aircraft's operating limitations.

Remove Complacency

Another "Remove Before Flight" mentality consideration is any hint of complacency. The reliability and quality of modern general aviation aircraft can lull any of us into a complacent attitude: "There wasn't anything wrong with the airplane when I inspected it this morning, and nothing went wrong on the flight. Besides, it's going to be dark before I get home if I don't get going now. We can skip most of the preflight."

If you find yourself cruising toward complacency, just think about how you would feel if, after skipping that "unnecessary" preflight, you discover in the dark that your lights aren't working. A smart pilot always assumes something will go wrong and develops plans, e.g., alternate airports and flashlights, to mitigate, if not prevent, adverse consequences.

Have Fun!

You can remove doubt by removing ignorance, distractions, and complacency from your preflight inspection process. If you are careful, methodical, and meticulous, you will be not only legal, but more importantly safe, when beckoned by those blue skies and tailwinds.

Doug Stewart is the 2004 National CFI of the Year, a Master CFI, and a DPE. He operates DSFI, Inc (www.dsflight.com) based at the Columbia County Airport (1B1) in Hudson, New York.

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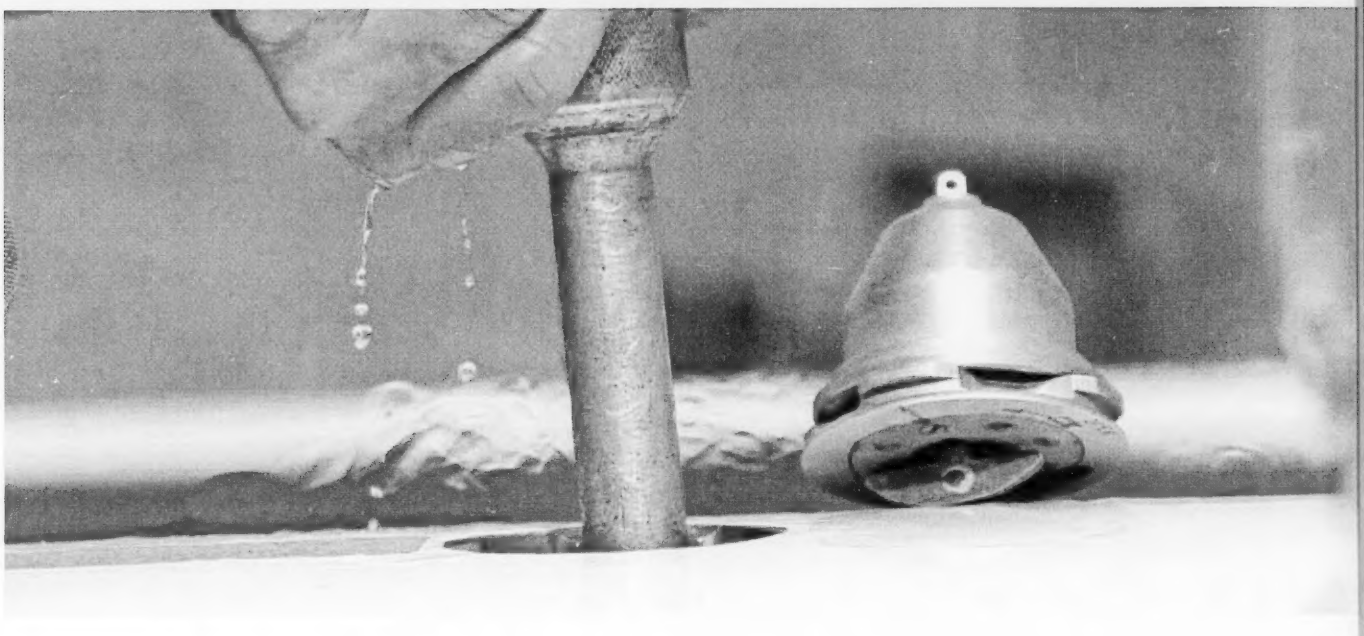


Why Does My Airplane Smell Like It Has Been Drinking?

PETER ROUSE

There are three things that you will probably never hear a pilot say. The first is, "I don't like to talk about my airplane." The second thing you are not likely to hear is, "I want to buy a small watch with no features." And the last, which is the real reason for this article is, "I just can't believe how cheap it is to fly."

It is not cheap to fly and one way airplane owners could reduce the cost of flying is to use automobile gasoline (autogas) in their airplanes. One could think that all the airplane owner has to do is buy the supplemental type certificate (STC) for a buck per horsepower, post a couple of placards, install an Adel clamp, bring fuel to the airport from the local filling station, and let the cost savings roll in. The flaw in chapter 1 of the "Airplane Owner's Guide to Riches" is the introduction of ethanol in autogas.

The use of ethanol as a fuel is not inherently dangerous, but using ethanol in an airplane not designed to use ethanol can be very dangerous.

Who Decided To Put Booze in Gasoline?

The federal government has not mandated the addition of ethanol to autogas; however, some legislative actions and air quality mandates have resulted in ethanol being added to autogas. Some of the reasons for ethanol in autogas are:

- On December 19, 2007, the President signed the Energy Independence and Security Act of 2007, which requires the use of 15 billion gallons of grain/corn-based ethanol (renewable fuel) by 2015.
- Individual states are free to develop their own ethanol fuel-blending laws. Some states are introducing legislation mandating 10 percent ethanol-blending in all grades of auto fuel. This action is not to meet U.S. Environmental Protection Administration (EPA) oxygenate standards, but rather to meet the demands of local/national ethanol producers or other mandated EPA emission requirements.
- Individual fuel producers are free to add oxygenates to fuels to meet other EPA mandatory emission and benzene cap requirements in high density population areas, or to comply with state law.

What Stops Me From Using Autogas With Ethanol?

There are two primary reasons an airplane owner cannot use autogas with ethanol. For one, the autogas

STCs for general aviation aircraft prohibit the use of autogas containing ethanol. And, two, it can be dangerous.

The first point says the STC prohibits the use of autogas with ethanol. So, what's the worst thing that can happen? The prohibition exists because of the second point. The use of ethanol as a fuel is not inherently dangerous, but using ethanol in an airplane not designed to use ethanol can be very dangerous. The primary concerns of using ethanol in airplanes not designed for its use are:

Volatility: The addition of alcohol to autogas adversely affects the volatility of the fuel, which could cause vapor lock. The volatility of the fuel is its tendency to vaporize, which is directly related to its vapor pressure. The higher the vapor pressure of a liquid at a given temperature, the higher the volatility and the lower the normal boiling point of the liquid. This means a higher tendency to form vapor at a given temperature. Literally, the fuel will "boil" at a lower temperature and form bubbles in the fuel system. Bubbles in the fuel system can result in a power loss.

Compatibility: Alcohol present in autogas is corrosive and not compatible with the rubber seals and other materials used in aircraft, which could lead to fuel system deterioration and malfunction. The compatibility of the fuel system with its fuel is critical for safe operation. Corrosion of aluminum fuel tanks can occur when water separates from the autogas that contains ethanol and then pools. Another compatibility issue is the "swelling" of rubber and plastic parts.

Phase separation: Alcohol present in autogas is subject to phase separation, which occurs when the fuel is cooled as a result of the aircraft's climbing to higher altitude. Phase separation is when a combined liquid separates into two different liquids. Think of an oil and vinegar salad dressing; when the dressing is shaken, the oil and vinegar combine. As the salad dressing sits, the oil and vinegar separate.

A similar situation exists when autogas with ethanol is combined with water. The presence of ethanol in autogas allows an amount of water to be absorbed, rather than remaining separate. There is a limit to how much water can be absorbed by autogas with ethanol, and the limit is dependent on the amount of ethanol in the autogas and the temperature of the fuel. If the water that has been absorbed by the autogas with ethanol separates, a layer of water and ethanol will form below the autogas. This water and ethanol blend is not the fuel an airplane engine likes to burn, so at least a partial, if not complete, power loss may occur.

Each airplane owner using autogas is responsible for determining that there is no ethanol in the autogas.

At 60°F, approximately 0.6 ounces of water can be absorbed by a one-gallon blend of 90 percent gasoline and 10 percent ethanol before the water will begin to phase separate. If the temperature cools to around 32°F, 20 percent of the total water present in the fuel will separate. On a 48-gallon fuel system, this means approximately six ounces of water could collect and go through the fuel system. The certification rules only require a sediment bowl (gascolator) capacity of one ounce for every 20 gallons. It doesn't take a degree in advanced math to see that this situation could lead to a problem.

What Do I Do?

Each airplane owner using autogas is responsible for determining that there is no ethanol in the autogas. On October 27, 2006, FAA issued Special Airworthiness Information Bulletin (SAIB) Number CE-07-06, which discusses ethanol in autogas and also contains a simple procedure to test for ethanol in autogas. To read this SAIB, go to: www.faa.gov/aircraft/safety/alerts/SAIB.

If you cannot find autogas that is free from ethanol, then you must use another approved aviation fuel. In almost all cases, this would be 100LL aviation fuel. The increased cost of 100LL is much less than the cost of fixing an airplane if the engine decides to lose power at an inopportune time. As the old pilot adage goes, "Takeoffs are optional, but landings are mandatory." The bottom line is to know what fuel you are using and for all of us: "Let's be careful out there."

Peter Rouse is an aerospace engineer at FAA's Small Airplane Directorate in Kansas City, Missouri. He is also a 1,700-hour pilot and a certificated flight instructor (CFI). He has flown aerobatics in competition and is an active member of the International Aerobatic Club.

MARTIN BAILEY

Nuts, Bolts, and Electrons

AT WAR WITH THE "DIRTY DOZEN"

Battlefield Tips Against a Mechanic's Worst Enemy

It's 1944 in the war-torn hills of Nazi Germany. On the eve of D-Day, a gravel-voiced Army major barks orders to ready his commando unit for a top-secret suicide mission behind enemy lines. Many might recall this vivid Hollywood scenario when hearing the term "Dirty Dozen." Although the film is not necessarily the inspiration for Gordon Dupont's long standing list of elements in the maintenance human error chain, an interesting corollary can be seen in its basic application to the breakdown of safety.

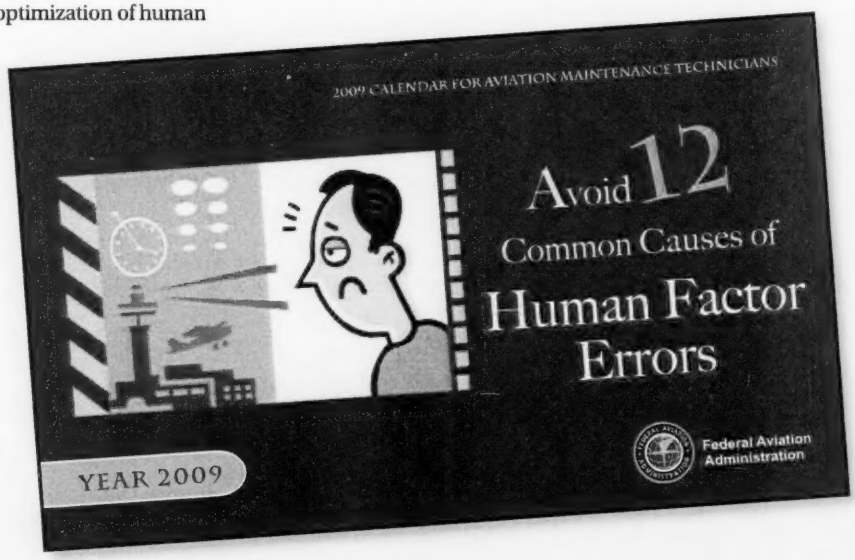
If you're familiar with the 1967 movie, the major (played by silver-haired, consummate tough guy Lee Marvin) heads a group of rowdy, insubordinate military convicts on a near-impossible assignment. Each soldier brings a distinct weakness to the team, e.g., paranoia or dementia, which, if unchecked, can either individually or collectively endanger the mission and the lives of each team member. Like the movie, the consequences of a mechanic not recognizing and heeding warning signs of errors can prove costly, if not deadly.

It's easy to lose sight of even some of the most basic warning signs of errors.

The "Lone Frontier"

The study of aviation human factors—or as some would say, the optimization of human performance—dates back to the early 1900s, when Orville and Wilbur Wright first wrestled with how to place a human body in their new flying machine and still have it take to the air. Despite its significance, the human factors buzz often took a backseat to mastering the mechanics of flying and appealing to the budding consumer demand for aviation. Over the years, advancements in technology, along with the multiple layers of security and redundancy, have reduced the risks of flying to where many could consider human factors as the "lone frontier" of aviation safety.

The NTSB reports that approximately 80 percent of all aviation accidents are caused by the failure of humans rather than machine failure. Although pilot operations get the lion's share of attention when it comes to human factors studies, accident data indicate a need for greater emphasis on the mechanic side of the house. Of course, nothing demonstrated this more dramatically than the 1988 incident when an Aloha B737 suffered an explosive decompression at 24,000 feet. This tragic event, triggered by oversight in maintenance procedures, opened many eyes to the consequences of human error in maintenance and led to a more active FAA role. In the subsequent 20 years, regulatory agencies worldwide developed



Every year the FAAST team produces a popular pocket calendar that highlights each of the Dirty Dozen.

programs to explore the dynamics of human error and mitigate its effect in aviation maintenance.

Know Thy Enemy

Ask any soldier and you'll likely be told that the key to a successful battle plan is to know your enemy. Enter the "Dirty Dozen," the early-1990s brainchild of Special Programs Coordinator Gordon Dupont of Transport Canada. With previous experience as a technical investigator for the Canadian Aviation Safety Board, Dupont witnessed firsthand the tragic results of maintenance and human error. To mitigate these errors, Dupont developed 12 basic factors of error (see Figure 1) ranging from mental, to physiological, to environmental elements, that individually, or in concert, form the core of the error chain that can lead to tragedy.

What exactly is so dirty about the Dirty Dozen? You see them on breakroom posters, or in PowerPoint presentations, but is their importance truly recognized? Unfortunately for many maintenance professionals, they can be overlooked and considered common sense guidelines that any good mechanic should recognize. That is the challenge. While appearing obvious and familiar, these elements can be elusive and their danger disguised by the myriad of routine distractions, even when right under your nose. Add the unique hazards of an aviation maintenance environment, e.g., extreme heat or cold, strenuous actions, confined spaces, and the well-known "time is money" mantra, and error has every opportunity to rear its ugly head.

"It's easy to lose sight of even some of the most basic warning signs of errors," explains FAA Human Factors National Staff Specialist Jay Hiles. "It's a domino effect that can quickly get out of control, even for an experienced mechanic."

Although not specifically listed in the Dirty Dozen, the element most commonly attributed to maintenance-related aircraft accidents is failure to follow procedures. This unfortunate circumstance can be the result of any one or more of the 12 factors, and it underscores the importance of staying on top of your game to recognize all possible warning signs.

Arm Yourself (with Knowledge)

"FAA is leading the way in implementing new programs and training aids in the maintenance human factors field," said Hiles. "The previous four years have been especially active with several new research and development projects, including a line operations safety audit, as well as a fatigue risk-management study, to help combat this long-time nemesis of mechanics." In addition, FAA also hosted its first aviation fatigue management symposium in June 2008.

THE DIRTY DOZEN

1. **LACK OF COMMUNICATION** Lack of clear, direct statements and good, active listening skills
2. **COMPLACENCY** Self-satisfaction accompanied by a loss of awareness of the dangers
3. **LACK OF KNOWLEDGE** Lack of experience or training for the task at hand
4. **DISTRACTION** Loss of focus, mental/emotional confusion, or disturbance
5. **LACK OF TEAMWORK** Lack of working together to achieve a common goal
6. **FATIGUE** Weariness from labor or exertion, nervous exhaustion, temporary loss of power, and ability to respond
7. **LACK OF RESOURCES** Failure to use or acquire the appropriate tools, equipment, information, or procedures for the task
8. **PRESSURE** Creating a sense of urgency or haste
9. **LACK OF ASSERTIVENESS** Lack of positive communication of one's ideas, wants, or needs
10. **STRESS** Mental, emotional, or physical tension, strain, or distress
11. **LACK OF AWARENESS** Failure to be alert or vigilant in observing
12. **NORMS** Informal work practices or unwritten rules that are accepted by the group

Figure 1 – The human factors in aircraft maintenance most commonly leading to accidents (Dupont, 1997)

In 2006, FAA, along with a consortium of industry and government human factors experts, released the *Operator's Manual for Human Factors in Aviation Maintenance.* According to FAA Human Factors Chief Scientific and Technical Advisor Dr. Bill Johnson, who contributed to the project, "the manual is recognized among the global aviation community for providing guidance to establish a successful maintenance human factors program."

The element most commonly attributed to maintenance-related aircraft accidents is failure to follow procedures.

The Operator's Manual is posted on FAA's newly re-designed Maintenance Human Factors Web site (http://hfskyway.faa.gov/). Here you'll find videos, presentations, and a document library containing decades of human factors research all at your fingertips. Check it out!

A discussion of the war against human error wouldn't be complete without mentioning night vision goggles. Okay, maybe they're not really night vision goggles. But, you do have at your disposal a set of "human-factors spectacles" that, according to Dr. Johnson, "can open your eyes to threats or things that are about to go wrong." Putting your spectacles on, says Johnson, means standing back and noticing things that might be less obvious, but are potentially critical in recognizing a dangerous situation. For instance, is the weather affecting my ability to do my job safely? Do I have the proper tools and resources? Did I get enough rest last night? These, and more, are vital considerations on the job. Wearing "human factors spectacles" will provide a better perspective and allow you to take action before something goes wrong.

Your Mission

Are you ready to wage this war? You should be. Like it or not, a mechanic's daily routine is ripe for the possibility of error every single day. Enemies lurk all around, but luckily there are several weapons to keep them at bay. And, you are not alone. Thanks

Fast Track Your Medical Certificate

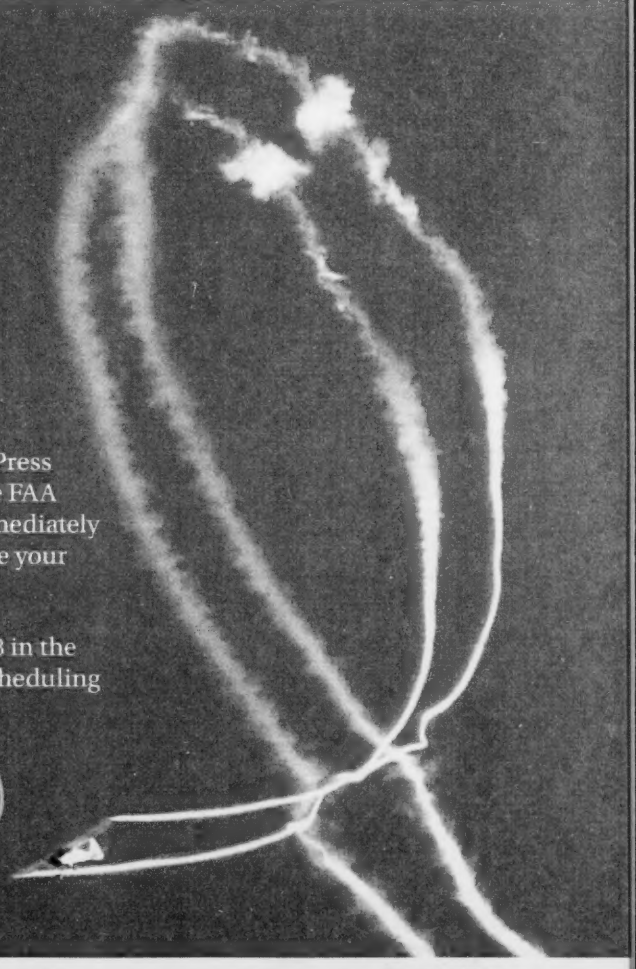
With FAA MedXPress, you can get your medical certificate faster than ever before.

Here's how: Before your appointment with your Aviation Medical Examiner (AME) simply go online to FAA MedXPress at https://medxpress.faa.gov/ and electronically complete FAA Form 8500-8. Information entered into MedXPress is immediately transmitted to the FAA and forwarded to your AME before your medical examination.

With this online form you can complete FAA Form 8500-8 in the privacy and comfort of your home and submit it before scheduling your appointment.

The new service is free and can be found at:

https://medxpress.faa.gov/



to the efforts of your "allies" in industry and government worldwide, we continue to see advancements, such as voluntary reporting programs, Safety Management Systems, and strategies to address human error specifically in general aviation maintenance.

"Eliminating risk associated with human factors is an ongoing process," states Hiles. "Forums such as the annual FAA/Air Transport Association of America, Inc., (ATA) Maintenance Human Factors Symposium, which any aviation maintenance professional can attend, will help the industry keep pace with the continuous evolution of systems, materials, and information technology."

It's easy to fall victim to the Dirty Dozen. In most cases they are manifestations of personal work habits that can lead to an innocent or unintentional error. The important point: Recognize the warning signs of error and carefully think through your actions. Being prepared and having a constant and consistent focus on maintenance human factors will send the Dirty Dozen running for cover every time.

Martin Bailey is manager of Flight Standards Service's Repair Station Branch.

Tom Hoffmann contributed to the article. He is associate editor of FAA Aviation News *and is a commercial pilot and holds an Airframe and Powerplant certificate.*

For More Information

FAA Human Factors Web site

http://hfskyway.faa.gov

Operator's Manual for Human Factors in Aviation Maintenance

http://www2.hf.faa.gov/opsManual/

Failure to Follow Procedures - FAAST Team Online Course

http://www.faasafety.gov/gslac/ALC/course_catalog.aspx

2009 Human Factors Symposium (September 2-3, 2009)

http://www.airlines.org/operationsandsafety/events/2009hfsymposium.htm

To receive a copy of the MX Human Factors Presentation System CD, send an email to:

aam520-mmpi-2@faa.gov

Calling All Mechanics

Keep Informed with

FAA's Aviation Maintenance Alerts

Aviation Maintenance Alerts (Advisory Circular 43.16A) provide a communication channel to share information on aviation service experiences. Prepared monthly, they are based on information FAA receives from people who operate and maintain civil aeronautical products.

The alerts, which provide notice of conditions reported via a Malfunction or Defect Report or a Service Difficulty Report, help improve aeronautical product durability, reliability, and maintain safety.

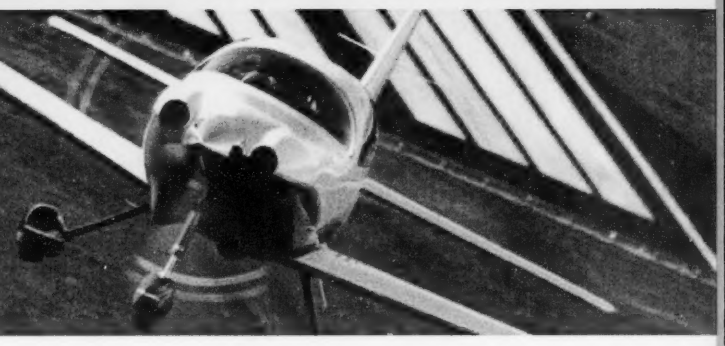
Recent alerts cover:

- **Exhaust system failures on multiple Cessna models**
- **Tire tube failure on the Cessna 172R**
- **Loose turbocharger oil lines on the Cirrus SR22**

Check out *Aviation Maintenance Alerts* at: *http://www.faa.gov/aircraft/safety/alerts/aviation_maintenance/*

TOM HOFFMANN

Hot Spots



The "Mechanics" of Runway Incursions

When most of us think of runway incursions and surface incidents, one word usually comes to mind—pilots. Granted, pilots do make up the majority (two-thirds, actually) of these incidents, and they remain the focus of initiatives to improve runway safety. However, there are others operating on the airport surface, including mechanics. Here's one example, adapted from the Aviation Safety Reporting System (ASRS) that generated two reports:

A Piper Seneca *being relocated by a mechanic was cleared by ground control to taxi from B3 to taxiway Lima. The mechanic taxied via Alpha to Lima then south on taxiway A9, but continued past the hold-short lines for the active runway, 11L. A Piper* Cherokee *had just finished its landing rollout on 11L but luckily reached taxi speed well clear of the* Seneca. *The* Seneca *also caused another* Cherokee *on a quarter-mile final for 11L to go around to avoid loss of separation.*

This incident shows how loss of situational awareness could lead to accidents. It also demonstrates a common theme in maintenance-related runway incursions.

A Vehicle/Pedestrian Deviation (V/PD) involves pedestrians, vehicles, or other objects interfering with aircraft operations by entering or moving on the runway or movement area without ATC permission.

The ABCs of V/PDs

First, let's review a few definitions. An airport has two distinct areas: Movement and non-movement. The movement area is under air traffic control (ATC) authority. It usually includes runways, taxiways, and other areas used for taxi, takeoff, or landing. The non-movement area includes taxi lanes, aprons, ramps, and other areas not under ATC control. In the non-movement area, it is the responsibility of pilots, mechanics, and other airport personnel to maneuver aircraft or vehicles without incursion or collision.

Most airports separate the two areas with adjacent solid and dashed yellow line ground markings. Moving from dashed to solid is permissible, but to move from solid to the dashed side requires ATC permission. (You might use "dash across" as a way to remember that you may continue if the dashed lines are closest to you.)

A *surface incident* is defined as any "unauthorized or unapproved movement in any movement area, or an occurrence in a movement area with the association of an aircraft that affects or could affect the safety of flight." FAA defines a *runway incursion* as "any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing or takeoff of aircraft."

Whether it is a surface incident or a runway incursion, FAA categorizes either in one of three ways: ATC Operational Error (OE), Pilot Deviation (PD), and Vehicle/Pedestrian Deviation (V/PD). A V/PD involves pedestrians, vehicles, or other objects interfering with aircraft operations by entering or moving on the runway or movement area without ATC permission. A mechanic involved in a surface incident or runway incursion while taxiing or towing aircraft for maintenance or re-positioning would fall into this category.

From fiscal year 2001 to 2008, there were 81 reported runway incursions during maintenance taxi, tug, or tow operations. Most resulted from one of three causes:

- Communications
- Airport knowledge
- Cockpit procedures for maintaining orientation

Communication Is Key

Effective cockpit/controller communication is key to safe surface operations. Although most mechanic incursions indicate few issues with acknowledging and reading back taxi instructions, they do reveal a pattern of unauthorized runway crossings. A good rule of thumb for taxiing or driving on an airport, even when activity is light, is to establish a mental picture of airport operations. Monitor traffic before you transmit to get a better idea of what is happening and what instructions to

expect. Keep communications clear and concise, and read back all clearances *verbatim*.

FAA has a waiver from the Federal Communications Commission (FCC) allowing mechanics operating an aircraft to include the word "maintenance" with the name of the company owning or operating the aircraft when communicating with ATC. This procedure helps ATC easily identify aircraft being taxied by a mechanic, and it has already been a valuable tool in reducing runway incursions.

An example of the enhanced taxiway centerline paint scheme.

Know Your Airport

Being familiar with the airport environment is critical, especially when conditions include bad weather, low visibility, and runway/taxiway closures. Having a printed airport diagram with you during the taxiing and driving operation is particularly important and helpful. The key is to stay alert and study the airport diagram before taxiing. Also, make sure you're aware of any *Notices to Airmen* (NOTAM) that may affect operations.

To foster improved situational awareness for ground operations, FAA has upgraded runway markings at all of the 75 largest U.S. airports. Two hundred and ninety-one smaller airports have already upgraded runway markings, which include an enhanced taxiway centerline paint scheme. The plan calls for more than 500 airports to receive the improved markings.

Procedures, Procedures, Procedures

No discussion of safe operations would be complete without including procedures. A review of incident reports of mechanic V/PDs shows that deviations from standard operating procedures are consistent contributors to these errors. Among the areas of concern: proper use of aircraft lights, radio work, and adherence to airport signs and markings.

Everyone on the airport has a responsibility to take prevention of runway incursions seriously.

"When you look at the total number of runway incursions," says Dr. Paul Foster, FAA Flight Standards representative to Office of Runway Safety and Operational Services, "most occur when the operator acknowledges the proper taxi instructions, but continues on the active runway or across the hold-short lines." A longtime advocate for airport safety and familiarization training for mechanics, Dr. Foster facilitates year-round training on runway incursion prevention and was a featured presenter at this year's Professional Aviation Maintenance Association's annual symposium in Dallas, Texas.

Everyone Has a Role

Everyone on the airport has a responsibility to take prevention of runway incursions seriously. "Just one maintenance taxi incident," adds Dr. Foster, "is one too many." To keep yourself safe from incident, take advantage of any runway safety training programs available at your airport. You can also find a number of online courses, presentations and training aids on www.FAASafety.gov. As the saying goes, "an ounce of prevention is worth a pound of cure."

Tom Hoffmann is associate editor of FAA Aviation News. *He is a commercial pilot and holds an Airframe and Powerplant certificate.*

For More Information

Known Best Practices for Airfield Safety

http://www.faa.gov/airports_airtraffic/airports/runway_safety/vehicle/

Advisory Circular 150/5210-20: Ground Vehicle Operations on Airports

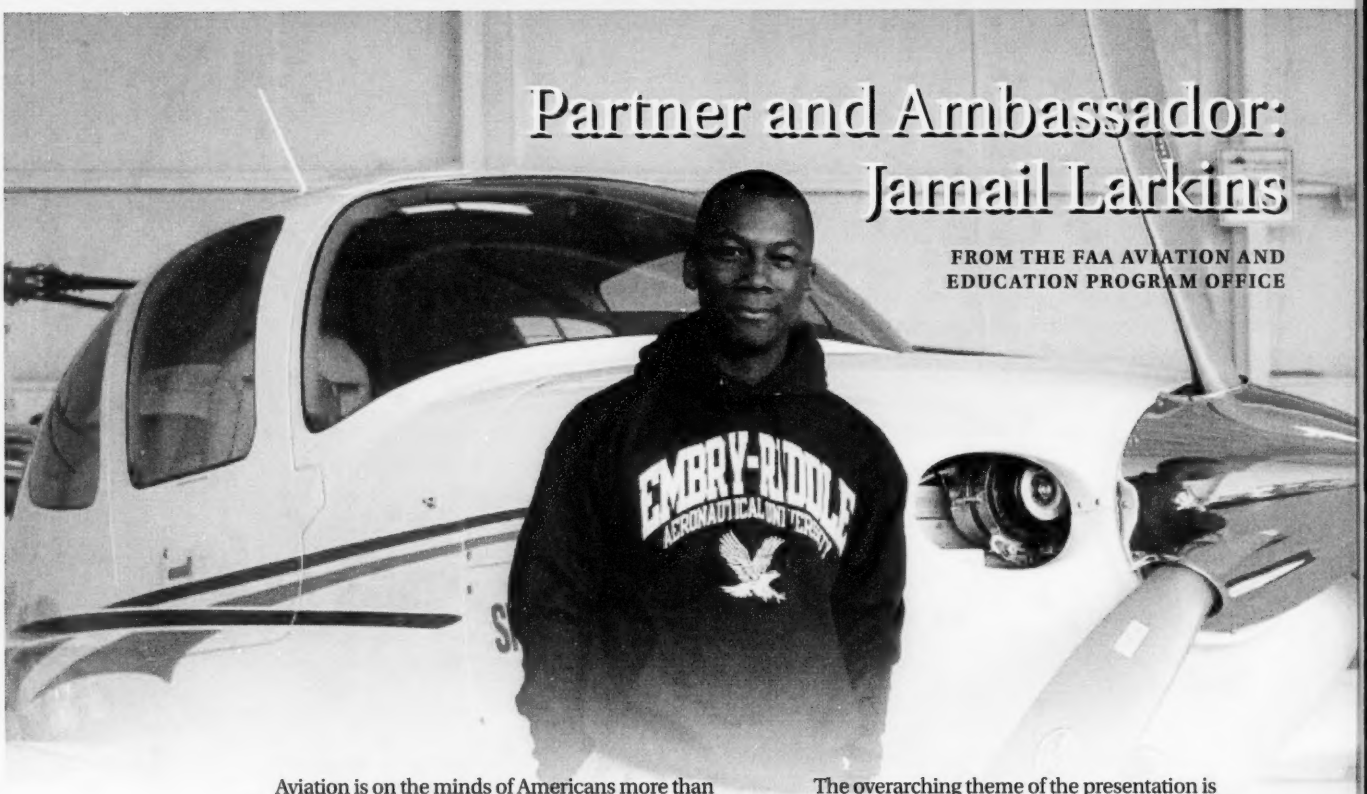
http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/media/150-5210-20/150_5210_20_chg1.pdf

Taxi Operations at Towered and Non-Towered Airports (Powerpoint)

http://www.faa.gov/runwaysafety/ace/presentations/4.ppt

Partner and Ambassador: Jamail Larkins

FROM THE FAA AVIATION AND EDUCATION PROGRAM OFFICE



Aviation is on the minds of Americans more than ever these days, in part due to the publicity surrounding the January 15 Hudson River "landing" of a bird-crippled commercial jetliner. The 58-year-old captain's years of aviation experience—along with the controller, the first officer, and three highly experienced flight attendants—highlight a lesser known issue: As many as 25 percent of all aviation employees are eligible to retire this year. Aviation needs newcomers to fill vital aviation positions and it needs people who can gain the training and experience that helped the Hudson River crew ensure a happy ending for all aboard.

To help meet this growing need, FAA tapped 25-year-old Jamail Larkins, one of the country's youngest air show performers, to serve as the FAA's official Ambassador for Aviation and Space Education. This partnership is successfully drawing attention to aviation career opportunities, in part by providing support for Larkins' efforts to educate students about aviation through his nationwide Dream Launch Tour.

Larkins says the same navigation principles that lead to successful flying can also lead to successful living.

Since Dream Launch began in early 2004, Larkins has traveled across the country speaking to elementary, middle school, and high school students about career opportunities in aviation and about the many programs youth can join to learn more about aviation. With the goal of spreading awareness of the need for qualified and talented employees to join the aerospace industry's 21st century workforce, the tour stops at approximately 18-20 cities a year.

The overarching theme of the presentation is to show students how to create a flight plan for their "life journey." Larkins notes that the same navigation principles that lead to successful flying can also lead to successful living and to making dreams a reality. Helping educate and motivate students to achieve their dreams is how the Dream Launch Tour got its name.

The primary component of each stop on the Dream Launch Tour is a high-energy presentation that begins with video clips of Larkins flying aerobatics in a high-performance aerobatic aircraft. He talks about how he started flight training at the age of 12, soloed in Canada at 14, and started his own aviation sales company at 15. He then glides into descriptions of aviation programs that are offered through the remainder of the year. This includes FAA's flagship educational program, The ACE Academies, which have reached over 1.2 million students and more than 70,000 teachers since 2003.

In some cities, the Dream Launch Tour conducts an essay contest in which the winners receive a Young Eagles flight with Larkins. Through a partnership agreement with Cirrus Aircraft, the students have an opportunity to take their Young Eagles Flight in a Cirrus SR22 aircraft.

As FAA continues to educate students about aviation, Jamail Larkins is front and center assisting with this important activity through his Dream Launch Tour appearances.

For more information on Jamail Larkins, check out this Web site:
http://www.erau.edu/dreamlaunch/meetjamail.htm

Flight Forum

False Credit

In the March/April 2009 issue of FAA Aviation News, *we used a photo of an instrument panel on pages 10 and 11. We have since learned that we gave credit for the photo to the wrong person. We apologize to Doug Reeves, owner/publisher of www.VansAirForce.net, for using the wrong credit line on his photo. The photo credit should have read "Original photo courtesy of Doug Reeves." We also corrected our Web site to reflect this change.*

Replacing an Airman Certificate

I have a commercial, single-engine land pilot certificate. I have not flown for more than 20 years but am not using instruction to become current. Since I stopped flying, however, I lost my hard copy of the certificate. How do I go about getting a replacement (with an English proficiency endorsement)?

—Via the Internet

According to FAA's Web site, www.faa.gov/licenses_certificates/airmen_certification/airmen_services/, there are two ways to replace an airman certificate. You can request a replacement certificate online or by mail. Allow four to six weeks for mail processing and seven to 10 days for online processing.

The FAA can only issue one copy of each certificate and cannot place the original date of issue on a replacement certificate or issue expired certificates. However, you can request an expired CFI letter at no charge.

Advice for the Birds

Susan Parson's "Checklist" column on bird strike avoidance in your January/February 2009 issue cements what I learned decades ago. I can attest it saved my life, possibly the aircraft, and others. I was flying a UH-1H Huey on a medical evacuation mission and suddenly my windscreen was filled with duck.

I pulled hard on the cyclic (control column or joystick to you airplane drivers) and Mr. Mallard impacted the chin bubble, shattering it. Instead of a face full of duck, it was served into my lap, whereupon I added the l'orange sauce. Had that bird gone through the windscreen, I don't know that I would have survived. The duck did exactly what Susan stated, he tucked his wings just before impact as I tried to climb, and it was just enough to move the collision point about three feet lower. I was only going 105 knots. Had we been going faster the first recognition would have been St. Peter. I do not know how one could avoid a flock or even a single bird at airliner speeds, but where most of us fly the advice is still valid.

—Derek Bernett
Via the Internet

Thanks for sharing your story with us. It's always good to know when we are on the right track with our information.

Magnetic Strip on Pilot License

An aviation medical examiner wrote to the *Federal Air Surgeon's Medical Bulletin* regarding a question he had been asked by several pilots. Hope this is helpful to other pilots who would like to know.

What does the magnetic strip on the pilot license contain and what it is or will be used for?

—An AME

From the Federal Air Surgeon's Medical Bulletin*: According the Airmen Certification Branch, the paperwork for certificates is examined and processed in Oklahoma City and the information to print the certificate is sent to a contractor. The "strip" helps ensure that the contractor matches the certificate with the correct card carrier that is mailed with the certificate. The strip contains a sequence number, card type, and the "unique identifier" number. The strip contains no personal information, such as a Social Security Number.*

FAA Aviation News *welcomes comments. We may edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses may not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Readers are reminded that questions dealing with immediate FAA operational issues should be referred to their local Flight Standards District Office or Air Traffic facility. Send letters to: Editor, FAA Aviation News, AFS-805, 800 Independence Avenue, SW, Washington, DC 20591, or FAX them to (202) 267-9463, or e-mail them to AviationNews@faa.gov.*

SUSAN PARSON

Editor's Runway

What Does FAA Really Do?

As is true for many pilots, my understanding of what FAA does was fairly vague before I started working here five years ago. It would take a long time to explain everything this agency does, because it's a big organization with big responsibilities to match—and I'm still learning every day.

The articles presented in this issue of the *FAA Aviation News*, though, provide a great way to introduce FAA's responsibilities for some of the functions that are most visible and most directly relevant to the general aviation community: Setting standards, certification, and ensuring continued operational safety. These topics also illustrate how these three functions operate in a cycle of continuous improvement.

Standards

FAA creates and, as necessary, amends rules and regulations that provide the safety standards for people, organizations, and equipment operating in the National Airspace System (NAS). You might be most familiar with the standards (rules) for pilot certification, as outlined in Title14 Code of Federal Regulations (14 CFR) part 61 and an associated document you know as the "Practical Test Standards," or PTS, as most of us abbreviate it. For aircraft and their associated parts, products, and appliances, the standards are set through regulations like 14 CFR parts 23 and 43 and described in documents like the Type Certificate Data Sheet (TCDS), Supplemental Type Certificate (STC), and Technical Standard Orders (TSOs), which are featured in this issue's articles.

Articles in this issue introduce FAA's responsibilities for setting standards, certification, and ensuring continued operational safety.

Certification

On the basis of established standards, FAA issues and renews certificates that authorize people, organizations, and equipment to operate in the NAS. Your pilot certificate(s) and ratings are issued to certify that you meet the standards set out in regulations like 14 CFR part 61. As described in several of this issue's articles, FAA also issues and renews certificates that allow manufacturers to build airframes, engines, propellers, components, and parts. Steve Thompson's "Airworthiness 101" article explains Type Certificates, Production Certificates, and Airworthiness Certificates—all of which are based on established standards. FAA also issues the certificates that authorize organizations to provide maintenance services.

Continued Operational Safety

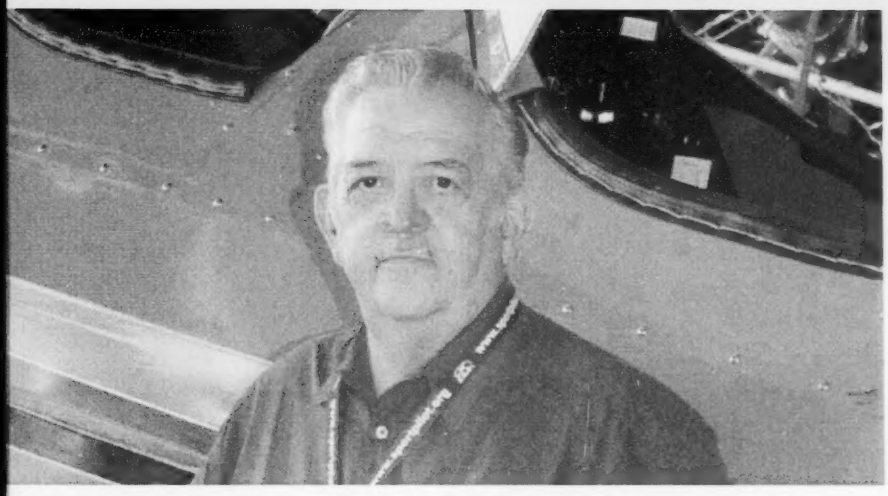
You might be surprised to learn that Continued Operational Safety (COS) is actually the biggest of the three core functions. FAA accomplishes this responsibility through safety surveillance and oversight programs, audits, evaluations, air traffic safety oversight, education and training, research, and accident/incident investigation.

The goal is clear: FAA's COS activities ensure that existing certificate holders continue to meet the safety requirements, standards, and regulations that formed the basis for their original certificate or certificate renewal. COS is also intended to ensure the integrity of a product throughout its service life. To this end, COS involves problem prevention, service monitoring, and corrective actions.

All these actions cycle back into modification of standards, whether for pilot/mechanic certification or for a product's design and production. The STCs and airworthiness directives (ADs) that you read about in this issue's articles illustrate the way FAA's continued operational safety activities can lead to necessary and important modifications to FAA standards.

And so the cycle continues, but always with the ultimate goal of ensuring that we all enjoy safe flights and happy landings.

Susan Parson is a special assistant in Flight Standards Service's General Aviation and Commercial Division. She is an active general aviation pilot and flight instructor.



Mentoring and Managing in North Dakota

LYNN MCCLOUD

FAA Faces: Dave Slaybaugh

If you fly in North Dakota, look around at the next pilot seminar. You might see a mustachioed fellow who was at your last seminar. He may have been at the seminar previous to that and the one before that—talking, joking, and giving advice.

The avid aviator is Dave Slaybaugh, assistant manager of FAA's Fargo, North Dakota, Flight Standards District Office (FSDO).

If you used to go to air shows in Illinois and Missouri, look closely and you might recognize the "farmer" who flew a comedy act in his Piper J-3 *Cub*. "It was a lot of fun," Slaybaugh says. "One time my farmer hat blew off and got caught on the J-3's tail brace wires. It was still there when I landed. The spectators thought it was part of the act."

What is not an act is Slaybaugh's serious aviation experience (11,500-plus hours). He got his A&P at a Des Moines technical high school right when he turned 18 and his Inspection Authorization followed three years later. Next to come was his pilot certificate. Slaybaugh went on to get his flight instructor and ATP certificates. He has piloted seaplanes, gliders, and lighter-than-air free balloons.

"I've never parachuted," he continues. "I did try to wing walk one time, but (Stearman aerobatic pilot) Gene Littlefield turned me down." That, and not flying the Space Shuttle, may be Slaybaugh's only aviation regrets. He has flown as a corporate pilot, been a chief pilot, worked at an airline, owned and run an FBO, instructed, and been a pilot examiner. Yet, his biggest joy is to bring people into aviation.

"Teaching is so rewarding," Slaybaugh says. "One of my students is now a corporate pilot flying a Falcon 900. One student was 78 years old and really enjoyed earning his private pilot certificate. Another time I got the opportunity to give one of my first instructors the necessary dual flight instruction for his ATP."

The transition to regulator was smooth for Slaybaugh. Twelve years ago he was closing down his FBO aviation business when an FAA inspector from the Springfield, Illinois, FSDO told him FAA was hiring. That's all it took. Slaybaugh applied and started his FAA career as an aviation safety inspector in Springfield.

Three years ago, he took the job at the Fargo FSDO so that he could get back to what he loves as much as aviation: teaching and mentoring. "Now," he says, "instead of teaching flying, I'm mentoring employees." A large part of the job of an assistant manager is mentoring new inspectors and helping employees with procedures, training, and problem solving.

"No one employee can be fully conversant in all aspects of safety oversight, so we back each other up, just like those redundant systems that help make our aviation system the safest in the world," Slaybaugh says.

As for those pilots he meets with at those seminars, Slaybaugh advises: "Plan what you're doing and follow your plan. And, always have a backup plan."

The backup can even be not flying. Slaybaugh recalls one time as a corporate pilot he refused to fly because of weather. "There was a long line of severe thunderstorms with high winds and hail directly across our flight path." The passengers were so intent on getting there they drove. "When I saw them a few days later," Slaybaugh said, "they admitted it had been dicey and they should not even have driven.

Know your limitations and do not exceed them.

"Know your limitations and do not exceed them."

U.S. Department
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